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*Section removed to show position of tap in chuck.

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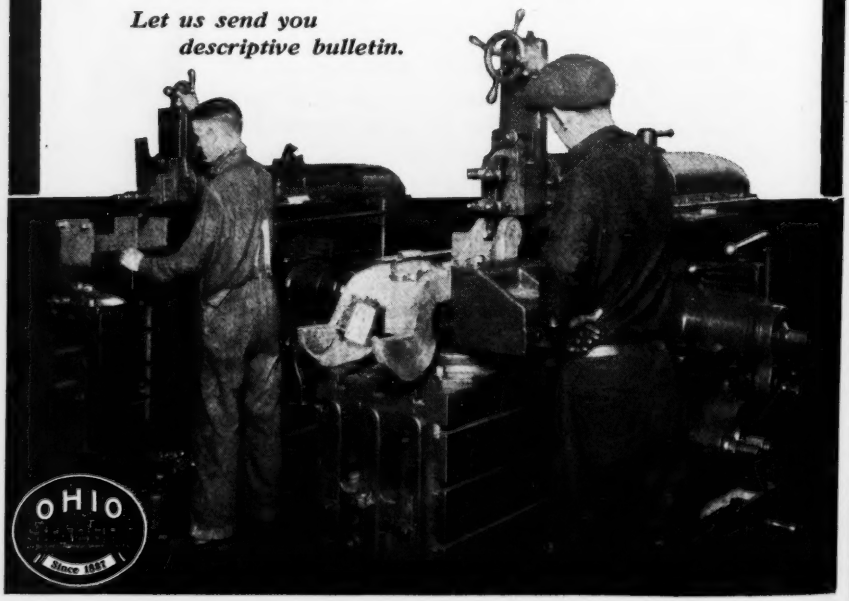

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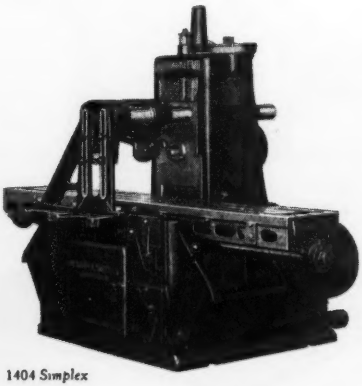

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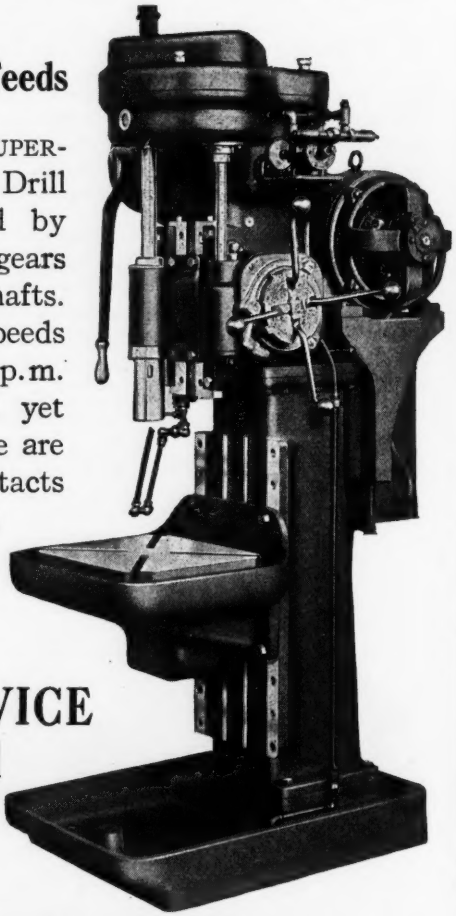

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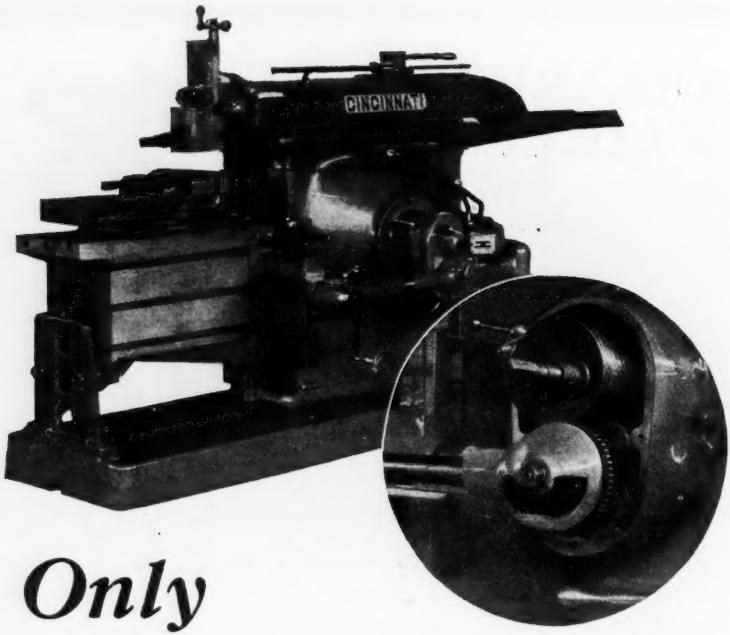

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Cincinnati Shapers
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MODERN
Machine Shop

A MAGAZINE FOR MACHINE SHOP EXECUTIVES

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Vol. 1 FEBRUARY, 1929 No. 9

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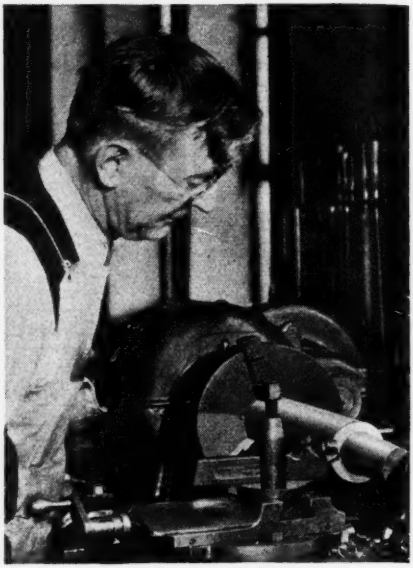
Armstrong Tool Holders are used in over 96% of the Machine Shops and Industrial Plants

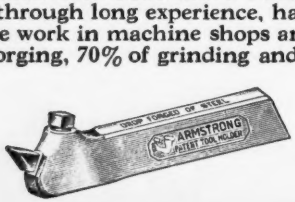


"Other Tool Holders may come and go, but yours last forever."

—W. S. Graham, Works Manager, Hupp Motor Car Corporation.

Upon receipt of our Catalog B-27, Mr. Graham wrote in part: "We are using your tool holders in our machine shop and tool rooms and are getting the usual efficient service from them. Other makes have been put on the market in competition with yours, but I have often said that other tool holders may come and go, but yours last forever."

This belief in ARMSTRONG Tool Holders is universal among industrial leaders who, through long experience, have found ARMSTRONG Tools exactly suited for the work in machine shops and tool rooms. They know that they save all tool forging, 70% of grinding and 90% of High Speed Steel on all operations of Lathe, Planer, Slotter and Shaper.



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Pipe Cutters
Hinged Vises
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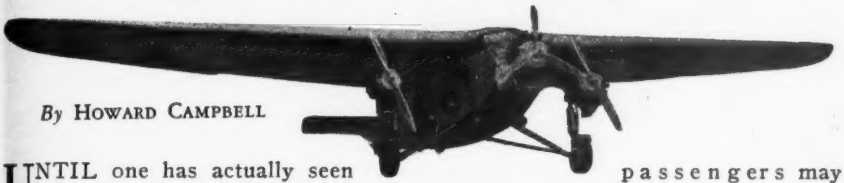
MODERN
Machine Shop

FEBRUARY, 1929

CINCINNATI, OHIO VOL. 1, NO. 9

Building the Ford-Stout Monoplane



By HOWARD CAMPBELL

UNTIL one has actually seen the great Ford-Stout tri-motored all-metal transport monoplanes which fly the Stout Air-Lines, it is almost impossible to conceive the mighty strides that have been made in recent years in airplane building. The precarious seat to which the passenger was strapped a few years ago has given away to a roomy cabin, completely enclosed, in which a dozen passengers may lounge at ease, wearing the same clothes that they wear on the street. The passengers look out at the passing landscape through clear plate glass windows, which may be opened, if desired, and comfort is assured in cold weather by an ample supply of heat in the cabin.

The Ford-Stout monoplane is built in a practically new "day-light" plant

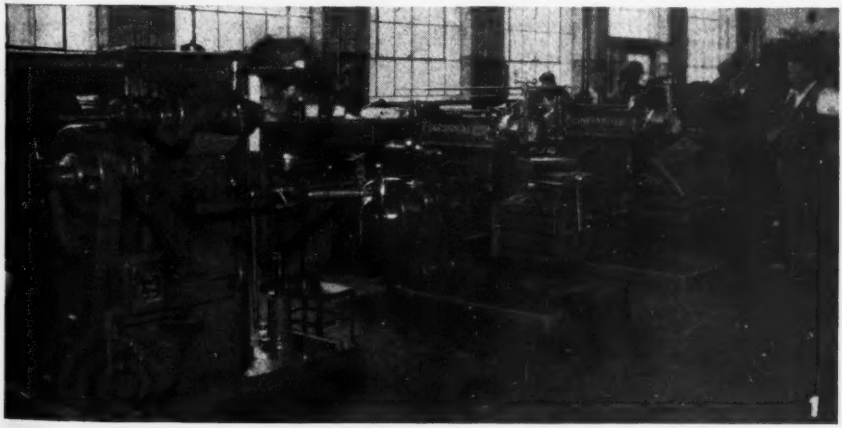
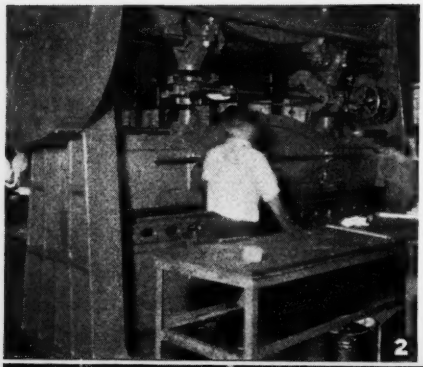


Fig. 1—Partial view of machine shop. Here the dies and special tools are made and conditioned.



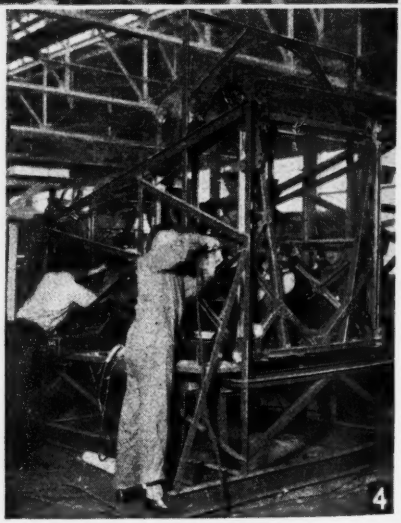
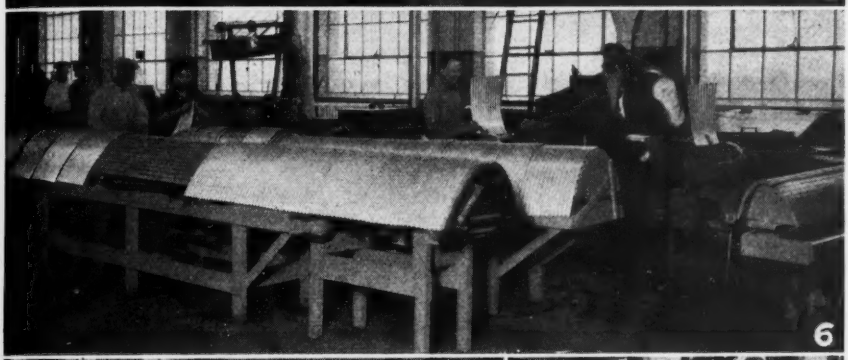
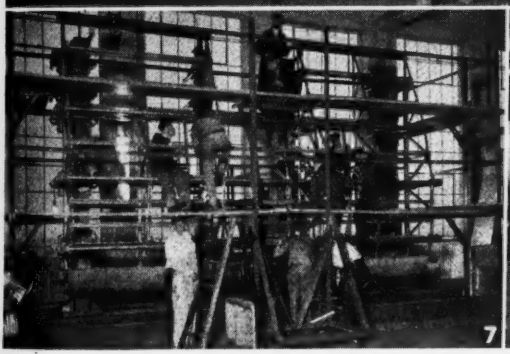


Fig. 2—Cutting and forming the ribs. Fig. 3—View through center of shop, showing fuselage in process of construction. Fig. 4—Each section is assembled in a jig.

at Dearborn, Michigan. Different types of motors are used, according to the size of the plane, but as these are purchased from motor manufacturers, the work here consists of building the plane and installing the motors in it. A machine shop, which is used mainly for making dies and tools and keeping them in condition, is located in one end of the plant. A partial view of this department, showing some of the milling machines, shapers, and lathes, is shown in Fig. 1.

The plane is of metal construction throughout, the body being built of duralumin ribbing and covered with "Alclad," which is duralumin that has been covered with a coating of pure aluminum and is thus rendered impervious to corrosion. This covering is called the "skin" and is from .010 to .020 inch thick, according to the requirements for the plane upon which it is being used. Most of the assembling operations consist of riveting, although a considerable amount of welding is done, forms and jigs being used to hold the parts in position while they are being





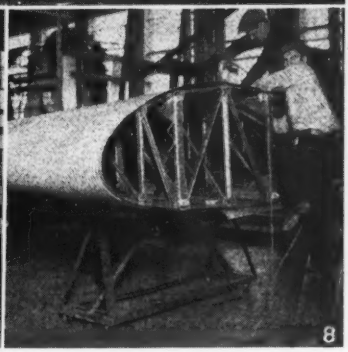
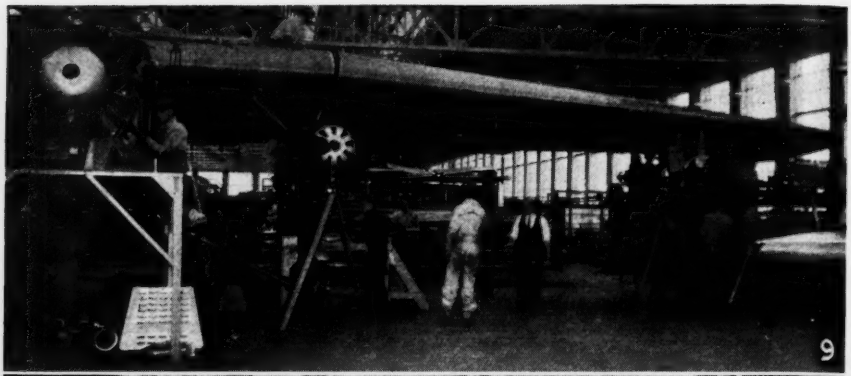


Fig. 5—Assembling a section of a wing-skeleton. Fig. 6—Forming the "skin" for the leading edge of the wing. Each piece is formed to occupy a definite position on the wing. Fig. 7—Building the skeleton of a wing. The huge jig insures that the wing will be accurately built. Fig. 8—Putting a trap-door on a luggage compartment in one of the wing-sections.

assembled. The duralumin ribbing comes into the plant in the form of sheets, which are cut and formed to the desired shapes and sizes in large presses, one of which is shown in operation in Fig. 2. The duralumin varies in thickness up to .102 inch, according to the type of plane in which it is to be used. The structure (or framework proper) of the plane is



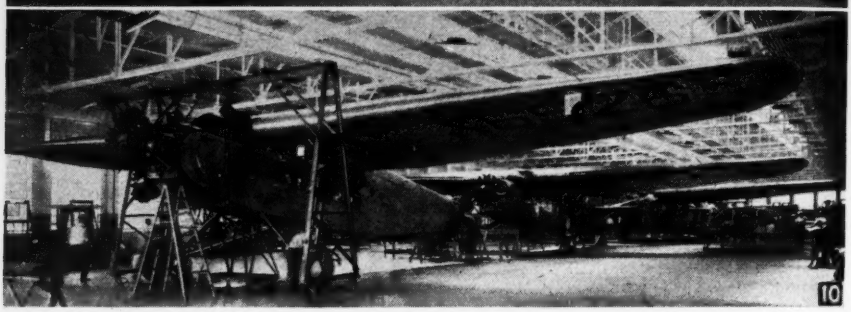


Fig. 9—Assembling the wing-sections to the fuselage. Fig. 10—Installing the landing gear. The plane is now practically complete.

coated with a solution of "Lionoil," which protects it from corrosion, before the skin is put on.

The planes are built according to the progressive assembly system, the raw materials coming in at one end of the plant and issuing at the other end as a finished plane. Forms or jigs are provided for all assemblies, and no two pieces are assembled together without the use of a jig to make sure that they are assembled correctly. A view across the center of the plant is shown in Fig 3, showing the jigs used for assembling the sections of the fuselage. One of the jigs for the rear section, in which a section can be seen under construction, is illustrated in Fig. 4. As strength on this type of work is obtained by the quantity rather than by the size of the rivets, the riveting hammers are of a small, light type which can be handled easily.

The mechanic shown in Fig. 5 is riveting the parts of a wing skeleton together. Only the central part of the assembly can be seen, this view being taken close enough to show how the pieces are clamped in position for assembling. Each piece is locked between an open-end clamp and a hinged clamp-bolt, both of these pieces being part of a unit which can be locked in any position on the vertical slide. This makes it possible to adjust the clamps for any type of pieces without loss of time.

The process of forming the "skin"

(Continued on page 76)

Semi-lapping *with a* Horizontal GARDNER GRINDER

THE use of a Gardner Horizontal Disc Grinder equipped with a fine-grain G. I. A. Disc, to produce a finishing or semi-lapping operation following milling or rough grinding, is becoming more and more common. The operation is simple and rapid—the accuracy obtained is remarkable.

Such an operation is shown above, where main bearing caps for one of the new Nash models are semi-lapped after milling, on a Gardner No. 86-30" Horizontal Grinder. The area ground is about 6 square inches, and approximately .005" to .006" stock is removed. The caps are ground to a 75% bearing contact, using a No. 365 G. I. A. Disc, and production is at the rate of SIX PER MINUTE.

While this illustration shows a 30" machine, the other sizes of Gardner Horizontal Grinders are, of course, also used for this type of operation.

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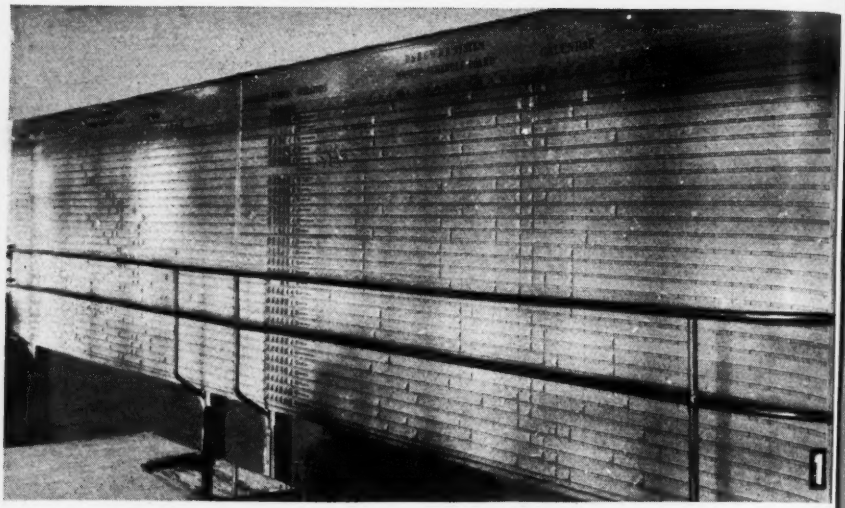


Schedule Board System in D. & R. G. Shops

By Jos. C. Coyle

With the aid of a schedule board, the general foreman of the D. & R. G. Railway Shops is able to keep a check on the progress of all work from his desk.

THE overhauling of a large mechanical unit, such as a locomotive, involves a number of operations, all of which must be completed within a given length of time or at a given date. Work at the Denver shops of the Denver & Rio Grande Railroad is expedited considerably by the use of schedule boards similar to that shown at the head of this article. There are a number of these boards in use, one in each department of the machine shop, one in the round house, and one in each of the other departments as well as a "master schedule board" in the general foreman's office. The "master board" enables the general foreman to tell at a glance just how the work in each department is progressing and just what the condition of each engine is.

The department schedule boards, while not as elaborate as the "master board" are built according to the same pattern and are operated in the same manner. The master board is eighteen feet in length by five feet high, and extends nearly the length of the general foreman's office. The board is divided into two sections, each of which is laid off in both vertical and horizontal lines. At the left of each section

FOSDICK

3-foot, 4-foot, 5-foot, 6-foot, 7-foot

"ECONOMAX" RADIAL DRILL

for heavy duty drilling

Universal control at head.

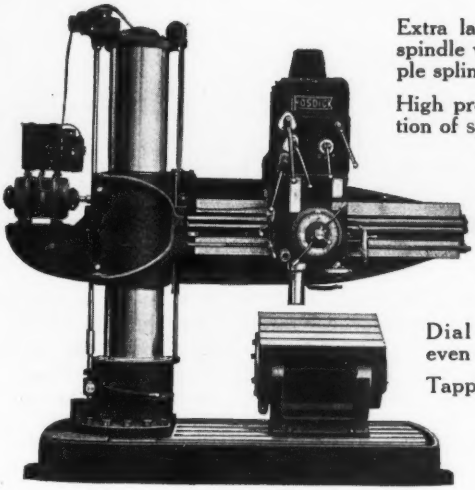
36 spindle speeds.

18 feeds and 3 pipe-tap leads.

Hardened alloy steel gears.

Automatic lubrication.

Tapered roller bearings.



Extra large alloy steel spindle with six multiple splines.

High pressure lubrication of spindle.

Power rapid traverse of head on arm with friction drive.

Quick return of spindle.

Dial divided into even inches.

Tapping and driving mechanism with indestructible multiple disc frictions.

The combined results of years of experience in designing and building drilling machines are incorporated in the design of this machine. It is a beautiful example of modern engineering skill.

Ask For Specifications

THE FOSDICK MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

are twelve vertical lines which provide for records of the progress of work on each of twelve locomotives, providing there are twelve in the shop. The status of each job is indicated by small squares of red, white, or blue cardboard.

Directly to the right of the twelve columns is a vertical column of figures, ranging, on the first section, from 10 to 38, inclusive, and on the second section, from 39 to 67, inclusive. These numbers designate the various operations required in making repairs on an engine. In front of each number is listed the name of the operation to which it refers, such as "flues out," "cylinders and valves rebored," and so on. In listing the same operations on the departmental schedule boards, ciphers are added, thus changing operation No. 10 on the master board to 100 on the others, 19 to 190, and the others accordingly. Two metal railings serve to maintain the proper amount of clearance and protect the cards from being brushed off as a result of carelessness.

Horizontally across the board, over each section, the days of the month are listed. Opposite each operation number, and also running horizontally, is a pair of grooves into which the upper and lower ends of the cardboard squares can be inserted. When an engine comes in for repairs, a white card bearing the engine number, operation number, and date the job is estimated to be out is placed in the grooves opposite each of the operations on the boards in the departments where the work is to be done. As each operation is completed, the white card is replaced by a blue one, under that date. If the estimated "out" date passes with the operation still unfinished, a red card is inserted in place of the white one.

At the time the cards for each engine are placed in the departmental schedule board, blank cards of the same color are placed on the master board in the corresponding column. As the various operations are finished, the cards are changed in the same manner as on the departmental board.

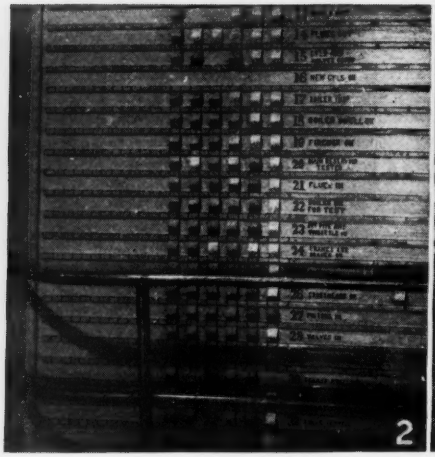
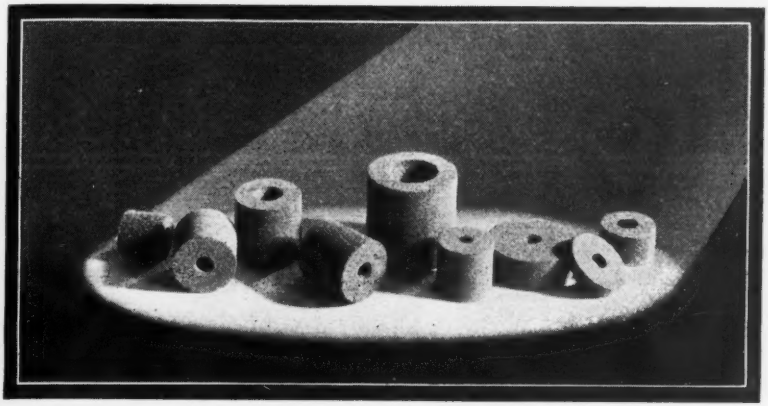


Fig. 2—Close-up view of section of "master schedule board."

Fig. 3—Department schedule board.



The "D" Wheel for Modern Internal Grinding

Accurate in Dimensions
Uniform in Grain and Grade
Correct in Structure

HERE is a wheel that is really modern—that is a worthy teammate for today's automatic internal grinding machines, making it possible for them to turn out the extremely high production of which they are capable.

The features that give the Norton "D" wheel its remarkable performance are a structure especially developed for the requirements of mass production and a new standard of uniformity in dimensions, in grain and in grade.

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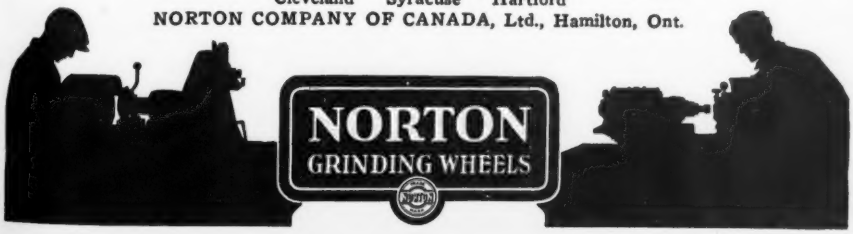


Date In _____ Class No._____ Eng. No._____

Date Out_____ Class Repairs _____

No.	Operation	Due Date	Act. Date	No.	Operation	Due Date	Act. Date
100	Mach'y Inspection	1-8		243	Main frames drilled	1-31	
110	Stripping complte'd	1-8		244	Frames planed complete	1-20	
111	Brake rigging del.	1-9					
112	Crossheads, pistons & valves del.	1-9		245	Frames welded	1-23	
				250	Guides on	2-3	
113	Rods, wheels & boxes del.	1-8		251	Guides planed & ground	1-30	
114	Ash pans, grates & netting out	1-8		260	Crossheads on	2-2	
				261	Crosshead assembled	1-31	
115	Motion work del.	1-8		262	Wrist pin turned	1-30	
116	All pipe stripping completed	1-8		263	Babbitt gibs	1-30	
				264	Crosshead planed	2-1	
117	Cab off	1-8		270	Pistons in	2-8	
120	Engine blocked	1-8		271	Piston rod finished	2-1	
130	Units out	1-9		272	Spider, bull ring & follower fin.	2-6	
140	Flues out	1-10					
150	Cyls & valves bored	1-15		273	Piston & rod assemd	2-7	
151	Valve bushings turned & in	1-14		280	Valves in	2-6	
				281	Valve assembled	2-6	
152	Cyl bushings turned & in	1-14		282	Valve, crosshead & stem finished	2-4	
160	New cyls applied	1-12		290	Engine truck ready	2-4	
161	New cyls drilled	1-15		291	Truck springs del.	2-2	
162	New cyls bored & planed	1-11		300	Trailer wheels OK	2-4	
				310	Driving wheels assembled	2-5	
163	Old cyls removed	1-10					
170	Boiler inspection	1-15		311	Wheels turned	2-4	
180	Boiler shell OK	1-30		312	Journals turned	2-4	
190	Firebox OK	2-1		313	Boxes bored & fitted	2-4	
200	Main reservoir tested OK	2-2		314	Boxes planed	2-3	
		2-4		315	Boxes brassed	2-3	
210	Flues applied	2-2		316	Lateral given machine shop	2-2	
211	Flues ready	2-2					
220	Boiler OK for test	2-2		320	Boiler tested OK	2-3	
221	Blowoff cocks & boiler plugs	1-31		330	Spring rigging up	2-5	
				331	Spring rigging forgings del.	2-4	
230	Dry pipe & throttle in	2-4		332	Driving springs del.	2-4	
231	Throttle & dry pipe ready	2-4		340	Units in	2-8	
				341	Units tested	2-9	
240	Frames & braces OK	1-30		342	Header applied	2-9	
241	Binders OK	1-30		350	Lagging in	2-10	
242	Front frames ready	1-30		360	Run boards & cab on	2-10	

Approved:

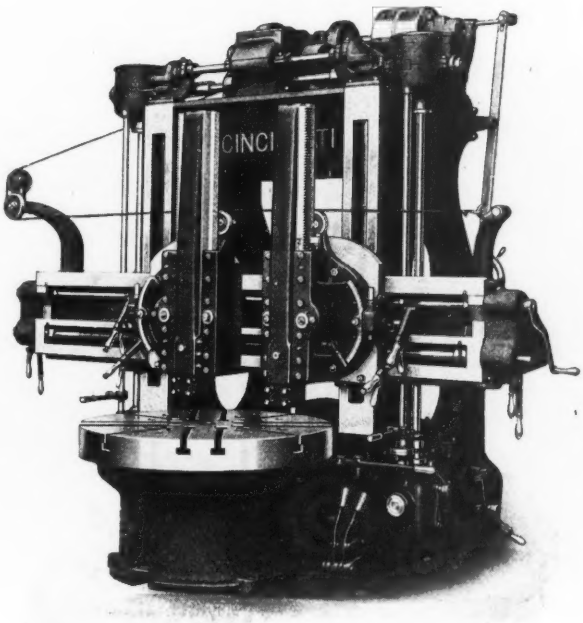
Shop Superintendent
Master Mechanic

Fig. 4—Work order for a D. & R. G. locomotive.

As each day passes, the red cards, indicating jobs that have gone past the due date unfinished, are moved up a day. Once each week a report of progress on jobs that have run over the alloted time is made. All necessary changes of cards are made daily, and when all the cards in the columns alloted to a certain engine show blue, they are taken out, bundled together, and filed away for future reference.

The cards on the departmental

CINCINNATI BORING MILL



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boards must correspond with the record on the master board at the close of each day so that the general foreman can, by referring to the board, ascertain the condition of each engine and the progress that is being made. He is thus enabled to take such steps as may be necessary to speed up work that is behind schedule.

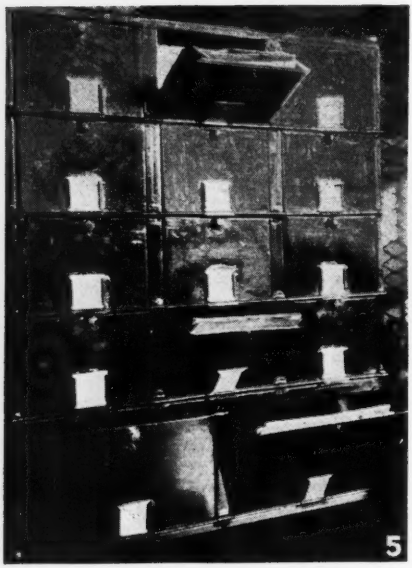

Fig. 5—Filing cabinet for orders for individual workmen.

A record of each job is kept by means of a work order that is made out when the engine comes in. This record is in the form of a bulletin on which is listed all of the repair operations with a place for "Date In," "Date Out," "Class No.," and "Engine No.," and columns for the date when each operation is estimated to be finished and when it is actually finished. Upon completion of the job, this record is approved by the superintendent and master mechanic and filed away.

The system described above produced such excellent results that it has been extended to include the workmen in some of the departments. The tool room has been given a sheet metal filing cabinet, twenty-four inches square by two inches deep, in which individual work orders are placed for the men in the department. The cabinet holds fourteen metal pockets, which are hinged on small rods that are soldered across the face of the cabinet. A small button at the top of each pocket provides access, the drawer tipping outward at a 45-degree angle when the button is pulled.

There are two pockets at the bottom, each eight by twelve inches, to hold general shop orders. Incoming orders are placed in one, and when the work is completed the order is transferred to the other. These shop orders enable the foreman to prepare individual work orders for the men, assigning to each man the particular work for which he is best fitted. Each individual work order is placed in the upper drawer that is assigned to the workman for whom the order is intended. Thus each man in the department can, in a minute's time and without bothering the foreman, learn what his next job is to be.

A similar cabinet is used in the sheet metal shop, but in a different manner. Here the foreman uses the cabinet for his carbon copies of shop orders and material orders. There are fewer men in this department, and instead of bearing the individual names of the workmen, the drawers are ticketed with the number or name of the car on which the work is to be done. As the jobs are finished, the orders are placed in a pocket reserved for that purpose and are later filed away for future reference. This system has been found very helpful in speeding up the work in these departments.

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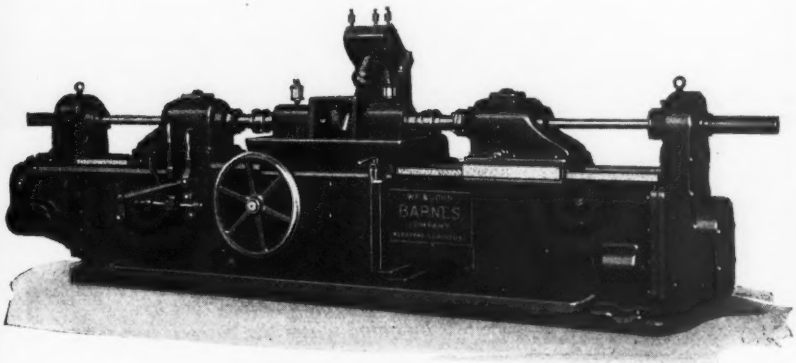

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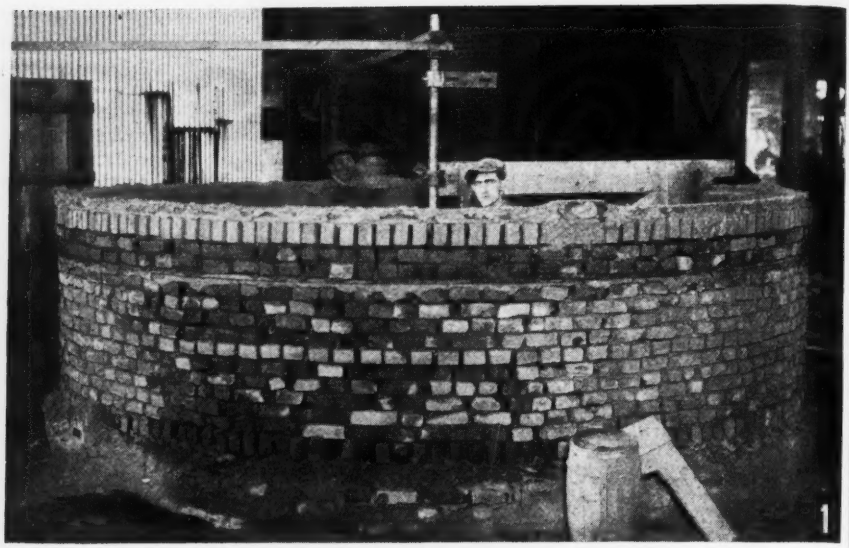


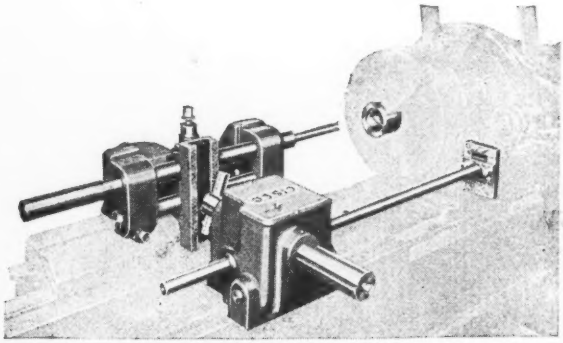
A Jobbing Machine Shop in the Blue Ridge

Here is a jobbing machine shop and foundry that has "gone after" business by going where the business is.

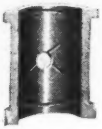
By AVERY E. GRANVILLE

ONE of the most interesting communities in the country is the comparatively new southern city of Kingsport, Tenn. Less than fifteen years ago the site upon which this city stands was an undeveloped plateau among the hills; today the industries around which the community is built include a branch plant of the Eastman Kodak Company, a shoe factory, a paper mill, a book-printing plant, a textile mill, two glass plants, a cement manufacturing plant, a leather belting plant, a brick plant, a plant for making milk products, and several others, including a jobbing shop known as the Kingsport Foundry & Manufacturing Company.

The Kingsport Foundry & Manufacturing Company serves the other industries of the town by furnishing them with castings and machine work which no other plant in town is equipped to handle. When, as sometimes happens in the best-regulated plants, a machine breaks down, or when a new machine of special design is to be built, this shop can be depended upon to furnish castings of any size called for. An idea of the size of some of the work that the shop is called upon to do can be obtained from a glance at the mold shown in process of construction in the illustration Fig. 1 at the head of this article. The casting to be made



Speed Up a Slow Spot!



OIL Grooving has always been considered a slow spot in shop production, especially in shops where the quantity of oil grooving does not warrant the purchase of an oil grooving machine. For such cases, we have designed the CISCO UNIVERSAL LATHE OIL GROOVING ATTACHMENT. It is readily attachable to any lathe from 14 inches to 24 inches, inclusive, in a short time.

This attachment cuts single, double, triple, or quadruple oil grooves of the figure eight type, inside or outside the bearing. The depth of the groove is controlled by the operator. The diameter of the work ranges from ⅝-inch to the maximum capacity of the lathe used. Made in three maximum lengths of 6 inches, 9 inches, and 12 inches, the variety of the work that can be oil grooved is very great.

If you will send us a few pieces of the work you oil groove, we will run them on our attachment, give you the actual time required to do the job, and return them to you. This test will not obligate you in any way.

The Cisco Machine Tool Co.

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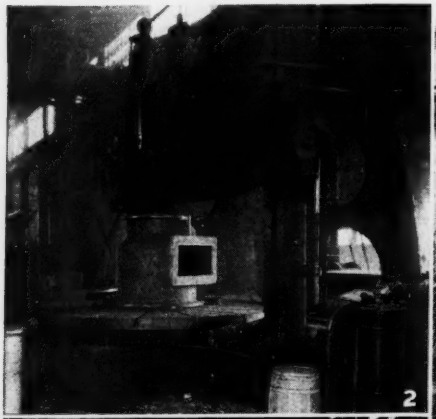

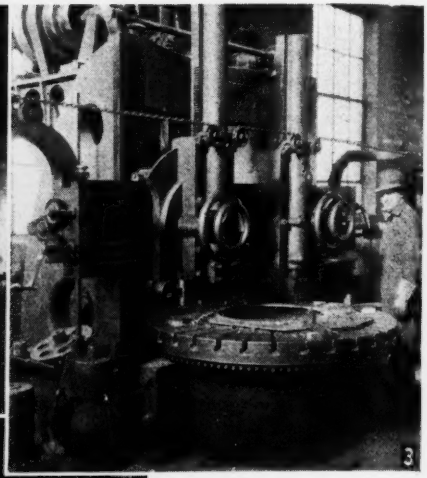

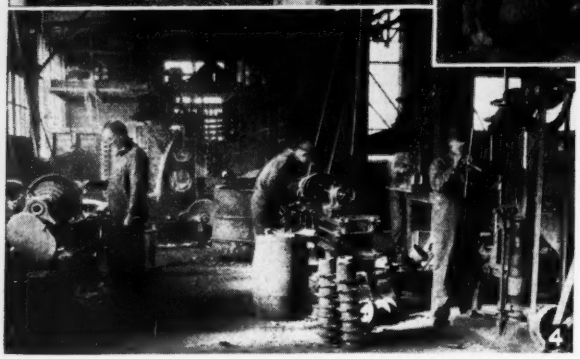

Fig. 2—Machining a casting for a gas plant. Fig. 3—Boring a flange for a special machine. Fig. 4—Smaller castings are machined in this department.

in this mold will weigh approximately six tons.

Large castings are machined on the boring mill shown in Fig. 2, which is of a size to take cast parts of practically any machine in use in this section. The piece shown in process is a casting for a gas plant. Work that is too large for the lathe and too small for the large mill is machined on the vertical mill shown in Fig. 3. The mechanic is shown boring a flange for a special machine.

The smaller machines are grouped together at one side of the shop, out of the way of the molding operations. This department, Fig. 4, includes a couple of Lehmann lathes, an "Ohio" planer, a keyseating machine, and two vertical drill presses. A big radial drill which stands at this end of the shop, but underneath the crane runway, is shown in operation in Fig. 5.

The large planer shown in Fig. 6 serves the double purpose of machining flat surfaces on parts that are too large to be handled in any other machine, and of a layout table. The illustration shows a mechanic in process of laying out a number of castings for machining on the horizontal boring machine shown in Fig. 7. The castings are parts for gas burners for a gas plant, and the latter illustration shows one of the castings being bored, faced, and reamed. This machine is particularly adaptable for drilling, boring, or reaming holes in

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that a single #7 x 1/2" Screw,
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35,000 other concerns speed up assemblies and cut costs by using Sheet Metal Screws in place of machine screws, bolts, rivets, etc., for joining and making secure fastenings to sheet metal.

No other method of fastening sheet metal can compare with Sheet Metal Screws. Only two operations are necessary. First, drill a hole. Then, turn in the Screw with a screwdriver. As the Screw is turned in it cuts its own thread like a tap.

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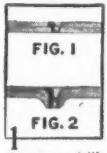

1 Punch or drill a hole as in Fig. 1; or pierce a hole as in Fig. 2.

2 Turn in the Screw with a screw driver.

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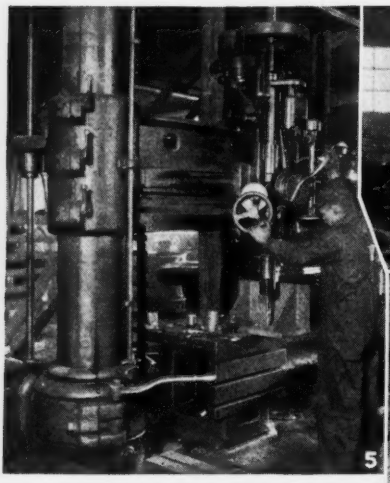

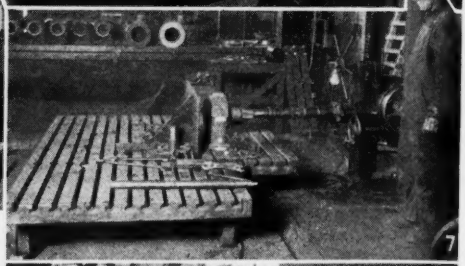

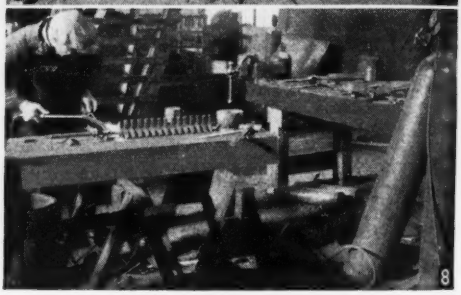

Fig. 5—The big radial is a busy machine in this shop. Fig. 6—The planer serves also as a layout table when necessary. Fig. 7—Reaming a part for a gas burner, for use in a gas plant. Fig. 8—The welding outfit saves its cost many times over in a foundry.

the sides of the large type of casting which can be handled easiest by allowing it to stand on its base and machining it horizontally. The spindle can be raised or lowered vertically, and the casting rests on a bed which rides on a track and thus can be moved in either direction.

One of the most valuable and necessary pieces of equipment in the foundry—the welding outfit—is shown in use in Fig. 8. Here the welder is shown using an Oxweld torch to repair the shaft of a cast iron furnace grate which was broken in chipping. With this torch and a little "Anti-Borax" welding flux, a break or crack in an iron casting is made as good as new.

The owners of the Kingsport Foundry & Manufacturing Company have located their shop as close as possible to the principal plants in a growing industrial community, where the need for parts and machine work for maintenance purposes presented an opportunity for service. It is generally conceded by business men everywhere that the South will develop more, industrially, in the next ten years than it has in the last fifty, in which case there should be many more opportunities for the kind of service that a well-equipped foundry and machine shop can render.

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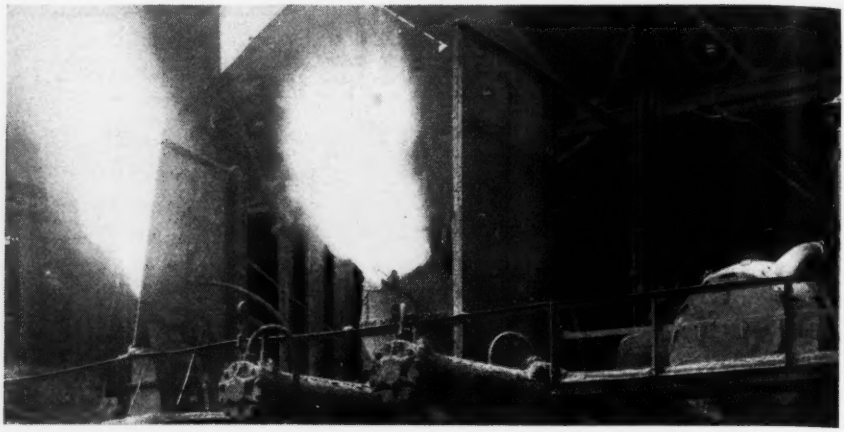

The Nature and Properties of Iron and Steel. II.

By GEORGE M. ENOS
Assistant Professor of Metallurgy, University of Cincinnati

This is the second article of the series, explaining the manufacture of wrought iron, crucible steel, and Bessemer steel. The third article will deal with the open-hearth method of steel production.

AS early as 3500 B. C. the ancients were familiar with iron, gold, silver, copper, tin, lead, and mercury. Little is known as to the actual extraction processes employed in early times, but it is probable that iron was reduced in charcoal fires in primitive forges. The early irons were almost certainly of the wrought iron type; that is, they were heated until they were soft enough to work, and then were hammered to shape. Forged swords and spears were used at an early date. Perhaps a certain amount of carburization and hardening took place in the heating process.

Even in comparatively recent times the production of any form of iron in large amounts was a rather difficult and uncertain process. Prior to the invention of the Bessemer converter, patented in 1856, steel for all purposes was made by the carburization of wrought iron, either by the "cementation" or "crucible" process.

In Table I the classifications of steel are listed. Steels are classified in various ways, according to the method of manufacture, or carbon content, or according to the use for which they were intended, or even in other ways. Cast irons were discussed in a previous article. It is advisable to distinguish between the ferrous materials other than the cast irons, in order to have a clear understanding of the materials that are to be discussed in these articles.

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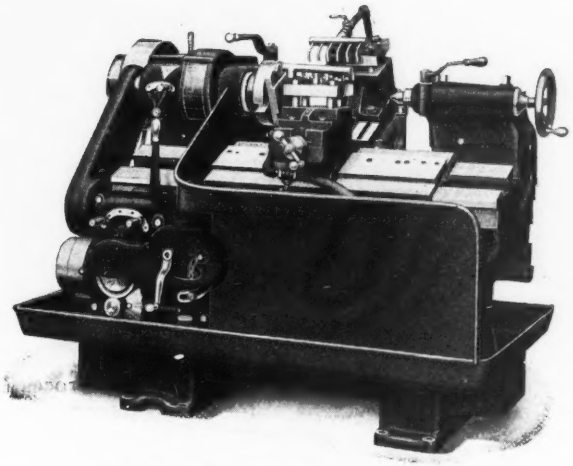

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"Commercially pure" iron may be produced in several different ways, the most common method being to refine pig iron in an open-hearth furnace until the impurities are less than 0.2 per cent. It is then cast into ingots and is known as "ingot iron." Armco Iron, product of the American Rolling Mills, is an example. Wrought iron is pure iron, except that it contains slag in appreciable amounts. The presence of the slag is considered

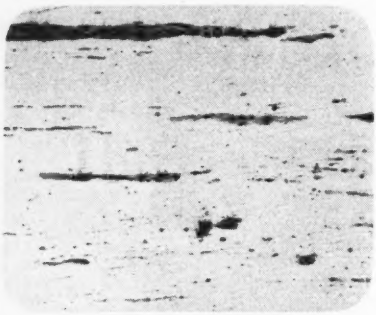

Fig. 1—Transverse section of wrought iron, showing slag inclusions, unetched. Magnification, X100.

beneficial. Both ingot iron and wrought iron are malleable as produced. Steel is an alloy of iron and carbon, and usually contains substantial quantities of manganese. The low carbon steels are quite malleable; the addition of carbon increases the strength, but decreases the ductility and malleability. Ingot iron can be distinguished from a very low carbon steel on the basis of manganese content, the steel seldom less than 0.20 per cent of manganese, whereas in the ingot iron the manganese should not be over 0.05 per cent.

The maximum and minimum percentages of the elements present in some ferrous materials are given in Table II. It should be understood that this table is representative rather than an exact listing of standard specifications. Standard specifications should be consulted for any specific job.

Wrought Iron

Wrought iron is produced in a special type of reverberatory furnace called a "puddling furnace," which has the fire-box located at one side of the furnace so that as the flames sweep over the charge, the heat is reverberated from the roof of the furnace. The materials used are iron oxides, in the form of hematite ore or mill scale, called "fetting material," and pig iron. The fettling material is "charged upon the hearth" or thrown into the furnace by hand. About 500 pounds of pig iron are melted at a heat.

When the iron is melted, the "puddler" works the heat with suitable bars so as to mix the iron oxides into the molten metal. The pig iron would contain as impurities, in addition to carbon, the metalloids, silicon, phosphorus, and sulphur, and also manganese. In the process, oxygen from the iron oxides combines with these impurities, some of which unite to form a slag while the carbon escapes from the bath of metal as a gas—carbon monoxide—at the top of the bath.

As the impurities are oxidized, the melting point of the iron is raised but the temperature attainable in the furnace, while sufficient to melt pig iron, is not high enough to keep the purified metal molten. So it partly solidifies, and is removed from the furnace in the form of pasty masses called "puddle balls," which usually weigh between 100 and 200 pounds each. The "puddle ball" contains much slag, and is only loosely held together, but it is immediately squeezed in a special machine which removes some of the slag and compresses the mass into a "bloom," which is then formed to the desired shape by rolling or forging.

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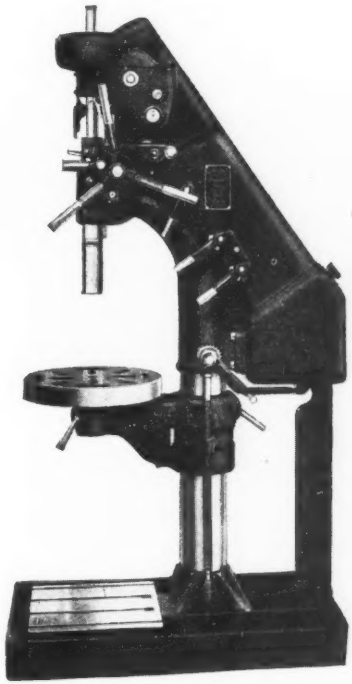


20-inch Self-Oiling, All-Geared Drill.

BARNES DRILL COMPANY

801-851 CHESTNUT STREET ROCKFORD, ILLINOIS

TABLE I.

CLASSIFICATION OF STEELS according to

Method of Manufacture From Pig Iron	Carbon Content*	Use	Soc. of Automotive Engrs.**	
Furnace		Machinery Steel	A numeral index is used. The first figure indicates the class to	
Bessemer Acid Processes	Soft, mild, or low carbon steels contain from 0.08% to about 0.20% carbon.	Rivet Steel	which the steel belongs. For alloy steels the second numeral indicates the approximate composition of the principal alloying element. The last two figures indicate the "points" (hundreths of 1%) of carbon.	
Bessemer Basic Processes				
Open Hearth Acid Processes		Axles		
Open Hearth Basic Processes	Medium or medium carbon steels contain from 0.20% to 0.30% carbon.	Boiler Plate		
Electric Acid Processes				
Electric Basic Processes		Rail Steel		
Duplex Process: (Acid) Bessemer converter followed by (basic) Open Hearth	Hard or high carbon steels from 0.30% to 1.5% carbon.	Structural Steel	Carbon Steels	1
			Nickel Steels	2
		Spring Steel	Nickel Chromium Steels	3
			Molybdenum Steels	4
Triplex Process: (Acid) Bessemer converter followed by basic Open Hearth followed by basic electric furnace.			Chromium Steels	5
		Tool Steel	Chromium-Vanadium Steels	6
			Tungsten Steels	7
		Etc.	Silico-Manganese	9
From Wrought Iron			Thus a S. A. E. 1020 means a carbon steel with approx. 0.20% carbon. S.A.E. 2340 indicates a nickel steel of approx. 3.0% nickel and 0.40% carbon. 71360 indicates a tungsten steel of approx. 13% tungsten and .60% carbon	
Puddling Furnace Carbonizing Cementation Process				
Crucible Melting with additions of C Mn etc. as needed.				

*Used when no special alloying elements are present.
†Some authorities include steels up to 0.85% carbon in the group of medium carbon steels.
**S. A. E. specifications in detail may be found in the A. S. S. T. handbook, or in publications of the Society of Automotive Engineers.

TABLE II.

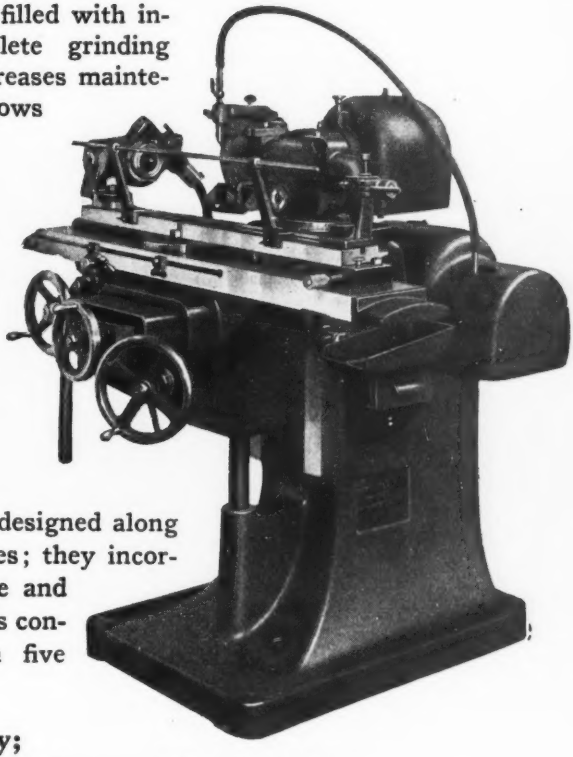
VARIATIONS IN COMPOSITION OF WROUGHT IRON AND IN STEELS PRODUCED BY VARIOUS PROCESSES.

Material	Carbon %	Manganese %	Silicon %	Phosphorus %	Sulphur %	Other Substances %
Wrought Iron	not over 0.08	not over 0.10	not over 0.35	not over 0.20	not over 0.04	slag 0.5 to 3.5
Ingot Iron	not over 0.02	not over 0.02	trace	trace	not over 0.02	
Crucible Steel	0.45 to 1.50	0.20 to 0.50	0.15 to 0.30	0.005 to 0.05	0.01 to 0.06	
Acid Bessemer Steel	0.10 to 0.60	0.30 to 0.50	0.05 to 0.20	not over 0.10	not over 0.06 *	
Basic Bessemer Steel	0.10 to 0.60	0.30 to 0.50	about 0.20	not over 0.10	not over 0.06	
Acid Open Hearth Steel	0.02 to 1.50	0.40 to 0.80	0.20 to 0.50	not over 0.10	not over 0.10	
Basic Open Hearth Steel	0.02 to 1.50	0.40 to 0.80	0.20 to 0.50	not over 0.10	not over 0.10	
Duplex Steel	0.02 to 1.50	0.20 to 0.80	0.20 to 0.50	not over 0.10	not over 0.10	
Electric Steel	0.02† to 1.50	0.20 to 0.80	trace	0.02	0.04	
Nickel Steel	0.05 to 1.60	about 0.50 to 0.60	about 0.2	not over 0.05	not over 0.04	0.5 to 4.0 Ni
Chromium Steel	0.05 to 1.60	about 0.50 to 0.60	about 0.2	0.05	0.04	0.2 to 18.0 Cr

* Except for screw stock. † Very little low-carbon steel is produced in the electric furnace.

Turn the Spotlight On Your Tool Room!

Is your tool room filled with inefficient and obsolete grinding equipment that increases maintenance costs and slows up production?



Replace inefficient equipment with Oesterlein - Ohio Grinders. They have inspired widespread confidence by their ability to grind to the highest tool room standards.

These grinders are designed along milling machine lines; they incorporate a heavy base and square column. This construction results in five big advantages:

(1) **Greater Rigidity;**
(2) **Truer Work;** (3) **Longer Life of Machine;**
(4) **Lower Maintenance Costs;** (5) **Increased Production.**

Write for Grinder Bulletin

The Oesterlein Machine Company
CINCINNATI, OHIO

OESTERLEIN
OHIO
MILLING
GRINDING DRILLING
EQUIPMENT

The valuable properties of wrought iron are the ease with which it may be welded, its resistance to certain types of corrosion, and the fact that it can be converted to steel by carburization, either by the cementation or crucible process. The distinguishing characteristic of wrought iron is the incorporation of slag in the essentially pure iron. The photomicrograph Fig. 1 shows the typical structure of a transverse section of wrought iron.

Steel Made From Wrought Iron

Cementation Process — No steel made by the cementation process is made in the United States. This process is used abroad in the production of high-grade cutlery steel, and consists essentially in completely carburizing a number of wrought iron bars and then melting the bars, thus getting rid of the slag.

Crucible Process — This process consists in melting small pieces of wrought iron in a graphite crucible with charcoal and ferro-manganese. Sometimes steel scrap is also added. The crucibles are heated in gas-fired reverberating furnaces, where they are held for some time to allow the gases to escape and the slag to rise to the top, from which it is removed with an iron rod. The fluid steel is poured into small ingot molds, which, after solidifying and being reheated, are rolled or forged to the desired form.

Since the wrought iron is low in impurities (excepting the slag which is removed in the melting operation), the crucible process produces a very high grade of steel. The molten metal absorbs carbon from the carbon with which it comes in contact and wide ranges are secured, but rarely is there less than 0.45 per cent of carbon present.

Manufacture of Steel from Pig Iron

Before taking up the methods of refining pig iron, it may be noted that the processes are of two kinds—acid and basic. These terms refer to the kind of lining in the furnace. Furnace linings are known as "refractories." An acid process means that the refractory lining is an acid material—that is, it is high in silica (sand). Basic linings may be dolomite or magnesite, which are materials that chemically and physically resemble limestone. If the refractory of a furnace is basic, and the flux used is acid (high in sand), the lining and charge will react at high temperatures to form a slag; but obviously the furnace lining will then disintegrate, possibly causing a break-down of the furnace. This means that the non-metallic part of the charge—the flux—in a furnace must be of the same general type as the refractory unless a neutral refractory is used. An example of a neutral refractory which does not react either acid or basic, is graphite. Neutral refractories are not widely used because of the high cost of these materials, although graphite crucibles are often used for small melting jobs.

The Bessemer Process — Production of steel in large tonnages dates from the invention of the Bessemer converter, which was patented in 1856. The illustration at the head of this article shows three Bessemer converters at the plant of the National Tube Company. Two of the converters are in action. The principle of this process may be described as follows: Air is blown through molten pig iron, contained in a special type of furnace, which is illustrated in Figs. 2 and 3. Air under pressure enters through trunnion A, Fig. 2, and passes into wind-box D where it is fed to the tuyere blocks which are set in the refractory detachable bottom E. The converter is a steel shell B, lined with

HYDRAULIC SINGLE SPINDLE DRILLER

This machine was especially designed to meet the demand for a Hydraulic Single Spindle Drilling and Boring Machine to which drill heads could be easily and quickly attached.

The machine has a semi-automatic hydraulic feed, the operator pulling the air valve to start the cycle.

Machine has a capacity of one 2½" drill in steel or its equivalent in a larger number of smaller drills.

Ask for our bulletins on this machine.

NATCO PRODUCTS

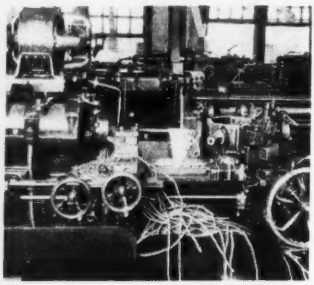
Standard Adj. Multiple Drills
Fixed Center Multiple Drills
Single Purpose Automatic Drills
Hi-Duty Single Spindle Drills
Drillers and Tappers
Special Machines

May we give you a proposition on your "holes"?

THE NATIONAL AUTOMATIC TOOL CO.

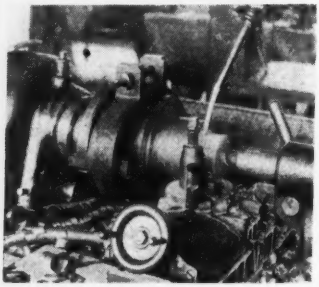
RICHMOND, INDIANA, U. S. A.

Used by Machine Tool



COURTESY OF THE WARNER AND SWASEY COMPANY CLEVELAND OHIO

OPERATION: TURN 1 INCH AND 1¾ IN DIAMETERS ON SCREW AT SAME TIME, CENTER AND FACE.
MACHINE: WARNER & SWASEY 1-A UNIVERSAL HOLLOW HEXAGON TURRET LATHE.
MATERIAL: MACHINE STEEL.
TIME FOR COMPLETE OPERATION: 23 MINUTES, FLOOR TO FLOOR.
CUTTING LUBRICANT: 1 PART SUNOCO TO 15 PARTS WATER.



COURTESY PRATT & WHITNEY COMPANY HARTFORD CONN

OPERATION: SPECIAL TAP
MACHINE: PRATT & WHITNEY MODEL B LATHE.
MATERIAL: TOOL STEEL
CUTTER SPEED: 12 R. P. M.
REDUCTION: 4½ TO 2!!
CUTTING LUBRICANT: 1 PART SUNOCO TO 30 PARTS WATER

Some of the Leading Machine Tool Manufacturers Who Use

Sunoco Emulsifying Cutting Oil

Arter Grinding Machine Co.
Abrasive Machine Tool Co.
Bilton Machine Tool Co.
Bullard Machine Tool Co.
Brown & Sharpe Mfg. Co.
Cincinnati Grinders, Inc.
Cincinnati Milling Machine Co.
Cincinnati Shaper Co.
Crankshaft Machine Co.
Davenport Machine Tool Co.
Foote-Burt Co.
Hanson-Whitney Machine Co.
Ingersoll Milling Machine Co.
Lees-Bradner Co.
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Van Norman Machine Tool Co
Warner & Swasey Co.
Walcott Machine Co.

SUN EMULSIFYING

SUN OIL COMPANY, Philadelphia

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Prominent Manufacturers

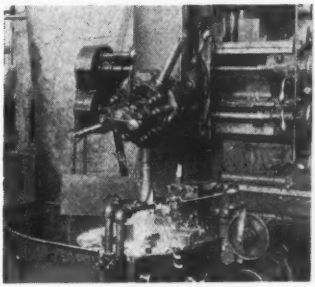
FASTER WORK DEEPER CUTS *At a Lower Cost*

Machine Tool Manufacturers want their machines to turn out the best possible work. Undoubtedly that is why so many use and recommend Sunoco—because they know it helps them do this at a speed and cost which cannot be duplicated.

The following advantages of Sunoco, so far as we know, are possessed by no other cutting lubricant:

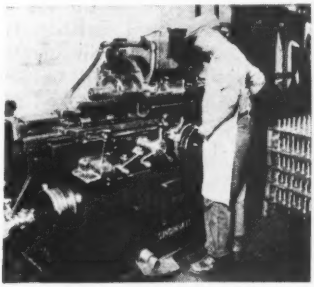
Increased cutting speed.
Increased quantity of metal removed per tool grind.
The quantity of water that can be added for a given kind of work.
The time the mixture can be used before replenishing.
Prevents rust and has unusual cooling properties.
Protects operators from skin infections.

As is proven by a steadily increasing list of users, these qualities make savings in cutting lubrication cost possible.



COURTESY OF BULLARD MACHINE TOOL COMPANY, BRIDGEPORT, CONN.

OPERATION: PINION
MACHINE: BULLARD TURRET LATHE.
MATERIAL: CHROME NICKEL STEEL.
FEED OF DRILL: .007 IN. PER REV.
SPEED: 85 FT. PER MINUTE. $2\frac{1}{8}$ IN. DRILL. 70 R.P.M.
BEVEL SWEEP: .014 PER REV.
CUTTING LUBRICANT: 1 PART SUNOCO TO 20 PARTS WATER.



COURTESY OF CINCINNATI GRINDERS INC. CINCINNATI, OHIO

OPERATION TEXTILE SPINDLES
MACHINE CINCINNATI GRINDER – 8 X 18 SADDLE TYPE
MATERIAL: HARDENED STEEL
STOCK REMOVED: .015 IN. FROM DIAMETER.
LIMITS: .00025 IN. FOR DIAMETER. .0002 FOR CONCENTRICITY
PRODUCTION: 85 PER HOUR
CUTTING LUBRICANT: 1 PART SUNOCO TO 40 PARTS WATER.

OCO

CUTTING OIL

SUN OIL COMPANY, Ltd., Montreal

DETROIT	JACKSON, MICH	NEWARK	ROCHESTER	TORONTO
FLINT	JACKSONVILLE	NEW YORK	SYRACUSE	TULSA
GRAND RAPIDS	MIAMI	PITTSBURGH	TAMPA	WILMINGTON
	MONTREAL	PROVIDENCE	TOLEDO	

refractory C, and mounted so that it can be rotated on its trunnions.

The molten iron may come directly from the blast furnace, or it may be melted in the cupola prior to charging to the converter. The oxygen of the air unites with some of the iron, forming iron oxide, which in turn is robbed of its oxygen by the silicon, manganese and carbon in the pig iron. It is probable that some silicon, manganese and carbon are directly oxidized by oxygen of the air.

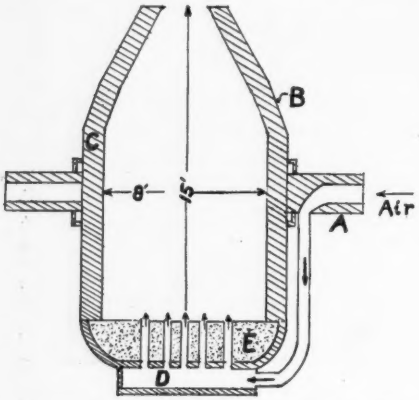


Fig. 2—Simplified sketch of section through concentric type Bessemer converter.

Carbon monoxide gas will be formed and will escape through the metal to the throat of the converter, where it burns. The flame produced by the burning gas is at first long and brilliant, but as the carbon burns out the flame shortens. The shortening of the flame indicates the end of the operation. Since the silicon and manganese will have been completely oxidized before the carbon is burned out, a slag consisting of the oxides of iron, silicon and manganese will be formed.

While making steel in the Bessemer converter is a "batch" process, the time of operation is very short, only from nine to ten minutes being needed to produce ten to fifteen tons of steel. The common Bessemer process in the United States is the acid process. A basic Bessemer process can be used by lining the converter with a basic refractory and charging with a basic flux, such as lim stone, which helps to remove the sulphur and phosphorus. In the acid Bessemer process, sulphur and phosphorus are not removed, therefore the original pig iron must be low in these elements. The basic process requires about twice as long as the acid process to make the same amount of steel, using the same size converter. In the Bessemer converter no fuel is used, because the oxidation of silicon, manganese and iron furnishes sufficient heat to keep the metal molten.

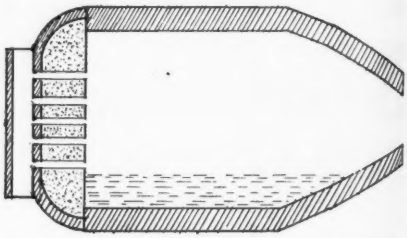
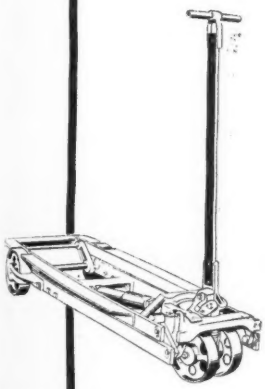


Fig. 3—Simplified sketch of section through Bessemer converter in position to hold molten metal, with tuyeres exposed. Air is turned on before the converter is tilted to the blowing position.

Gardner Catalog No. 27

The complete line of Gardner products, including the disc grinders, special grinders, automatic grinders, polishing lathes, disc wheel presses, fixtures, and accessories, is described in Catalog No. 27, which has been published by the Gardner Machine Company, Beloit, Wis. The book contains 315 pages of 8½ x 11-inch size, and describes fully the various machines made by this firm. The book is well illustrated with views of the individual machines and shows a number of the machines in operation.

Stuebing Cowans For The Illinois Central



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America should ship its goods on skid platforms—W. C. Stuebing

Multiple Operation Cutters Reduce Costs

By DONALD A. CLARK

MANY of the old-timers in the mechanical trades can still remember the time when practically all lathe work was done with a single-point tool, two different diameters in a hole called for two sets of drills and reamers, and a counterbore was made complete from a solid piece of steel. With the increase in the demand for higher production and lower costs, the single-point tool—in production work—has largely given way to the multi-cutting boring tool and reamer.

Tools are now made that finish several diameters in a hole in one operation, and the solid counterbore has been largely superseded by tools with renewable, interchangeable cutters of high-speed steel and with shanks and pilots of less expensive steel, heat-treated to give them the necessary qualities of hardness and toughness.

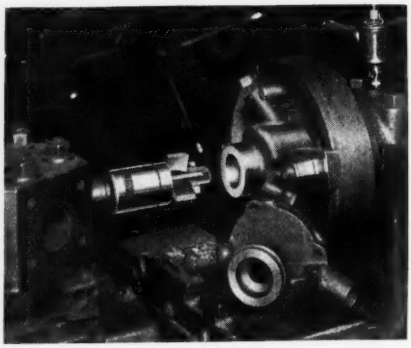


Fig. 1—Using an Eclipse multi-diameter cutter to machine bosses on cylinder heads.

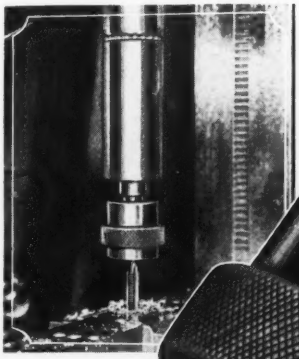
One of the first companies to recognize the need for tools of this type was the Eclipse Interchangeable Counterbore Company. Located in Detroit, in the midst of their best logical customers, the engineers of this firm kept pace with the needs of the automotive industry and high-production plants of other kinds, and, as a result, have produced tools that finish as many as eight diameters and eight faces in one operation.

A representative operation in which tools of this type are useful is that of machining the water outlet bosses on cylinder heads, shown in Fig. 1. The tool shown in the turret drills a 2 1/16-inch hole in the core, counterbores the large hole to 2-33/64 inches, and faces the end—two boring cuts and two facing cuts—in one operation. The diameters and depths are held to limits of .001 inch. The tool is held in an Eclipse No. 3 holder which is equipped with a ball thrust bearing that rides against the face of the work when the tool is in to the required depth. The use of this type of holder makes it unnecessary for the operator to take time to gauge the work, and the thrust bearing makes it impossible for the tool to mar the face of the work while in contact.

The illustration Fig. 2 shows an Eclipse tool in use for machining inflater bodies for use in the construction of gasoline pumps. The piece is of cast bronze and is being machined in a LeBlond turret lathe. This tool performs six operations, including the boring of one diameter to 1⅛ inch, a second to 1¼ inch, and a third to

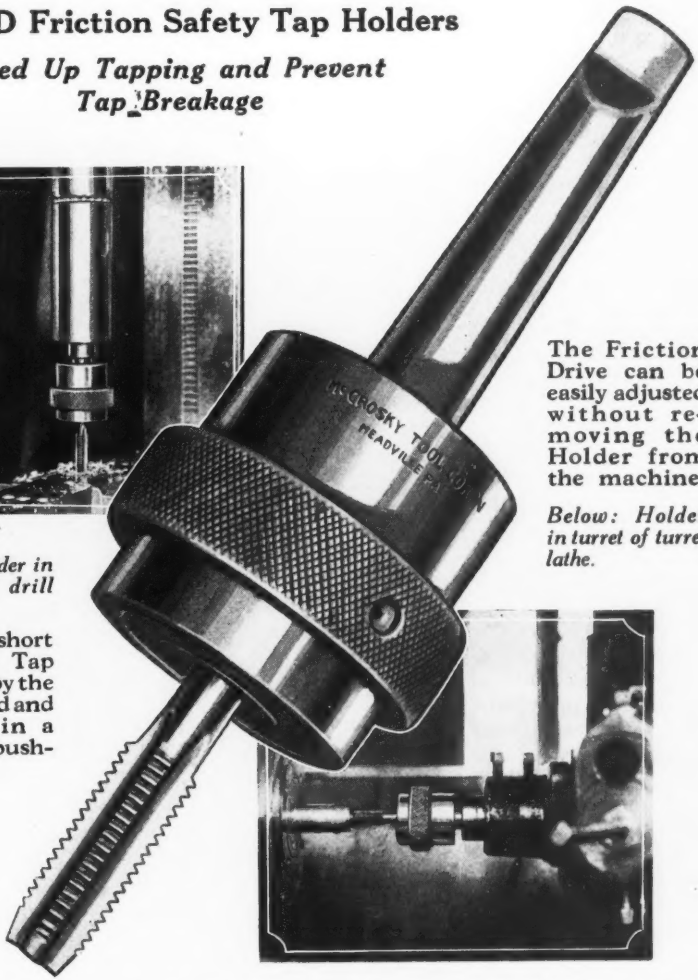
WIZARD Friction Safety Tap Holders

Speed Up Tapping and Prevent Tap Breakage



Above: Holder in spindle of drill press.

Note the short overhang. Tap is driven by the square end and is held in a floating bushing.



The Friction Drive can be easily adjusted without removing the Holder from the machine.

Below: Holder in turret of turret lathe.

WIZARD Safety Tap Holders will drive taps at drilling speed. But when the tap meets an obstruction or hits the bottom of a blind hole, friction slips and the tap stops. The operator does not have to feel his way. - - - - - Let us send you a WIZARD Safety Holder circular, free and postpaid.

McCROSKY TOOL CORPORATION

MEADVILLE PENNSYLVANIA

2 inches, the facing of the end of the piece and the cutting of two internal seats. All of these diameters and

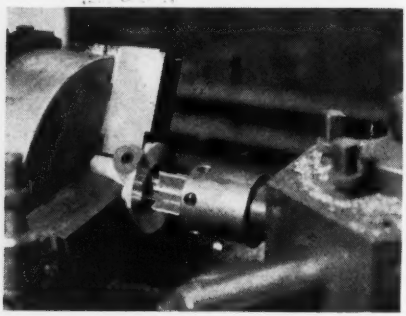


Fig. 2—The tool used here performs six operations in one cut.

faces are held within plus or minus .001 of each other.

The operator shown in Fig. 3 is rough and finish boring the valve-seat holes in cast iron bottoms for gasoline pumps, in which operation he uses several multi-operation cutters. Two of the valve-seats are in the top of the casting, and the third is on the inside, near the bottom, necessitating the use of a tool with a long shank. He rough-bores each seat to a 2-inch diameter, 1⅝-inches deep, and cuts the valve-seats, then moves the piece over to the other spindle of the machine and finishes the two diameters and two valve-seats with another multi-operation tool. A cross-section drawing of the valve-seat is shown in Fig. 4.

That part of the tool which cuts the valve-seat has four teeth, generated radially, so that the teeth can be ground on the face in the same manner as a milling cutter is ground. Approximately 100 pieces, or 300 holes, are finished between grindings of the roughing tool and 400 holes are usually finished with the finishing tool before it needs regrinding. While from .010 to .015 inch is removed from a blade in regrinding, there are three-fourths of an inch of blade to be used up before the blade is exhausted. These tools have been in use for eighteen months, and are good for eighteen more.

Another modern development in the line of production tools is the interchangeable holder, which is made to take any one of a variety of cutting tools. A set of twelve of these tools, made by the Eclipse Interchangeable Counterbore Company, is shown in operation in Fig. 5. These tools are used for semi-finish reaming all twelve

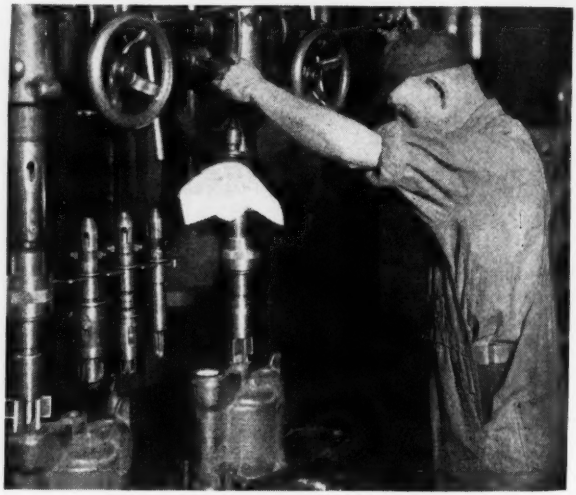


Fig. 3—Using multi-diameter cutters to machine parts for gasoline pumps.

of the valve openings in a six-cylinder motor block, which is done in one movement of the machine-spindle.

BRADFORD
RAPID PRODUCTION DRILLING MACHINES

MADE TO HANDLE ALL KINDS OF JOBS

Send us your Blue Prints or sample parts for production estimates.

The BRADFORD MACHINE TOOL COMPANY
659 EVANS STREET CINCINNATI, OHIO
Precision Lathe Builders Since 1840

The machine is a 12-spindle sliding head vertical boring machine, and the block is located in a fixture of the open-end box type, made so that it can be loaded direct from a roll conveyor line. The twelve spindles of the machine are equipped with Eclipse special holders, each holder being fitted with a tool especially designed for this operation. Six of the reamers are 1.411 inches diameter, for the six exhaust openings, and the other six are 1.474 inches diameter, for the intake openings. The bodies of the holders are slightly larger in diameter, and are ground to a sliding fit in the hardened bushings in the top of the jig. The spindles operate at a speed of 180 r.p.m., with a feed of .0055 inch per revolution. The length of the machined part of the valve opening is ½ inch, and the actual cutting time is 30 seconds. The design of the jig makes it possible to machine a piece complete, including handling time, in 54 seconds or at a rate of 60 blocks per hour.

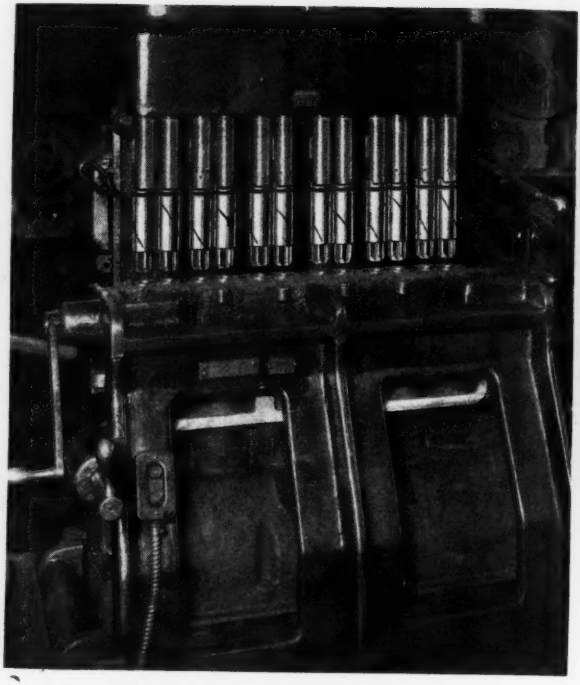


Fig. 5—The twelve valve openings in this cylinder block are reamed in 30 seconds with these Eclipse tools.

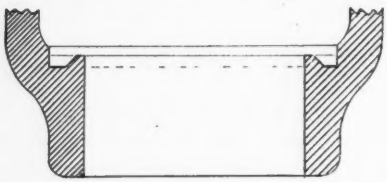


Fig. 4—Cross-section of part of pump-bottom, showing valve-seat.

The ability of a shop to get and hold business, or to manufacture a product at a cost low enough to enable the shop to compete successfully with other manufacturers in the same line of business, is depending more and more upon the ability of the owners to concentrate and simplify operations. Standardized, interchangeable cutters and tools which perform several operations in one cut are products of the age, and the plant executive who overlooks the possibilities in such tools may be seriously handicapping himself.

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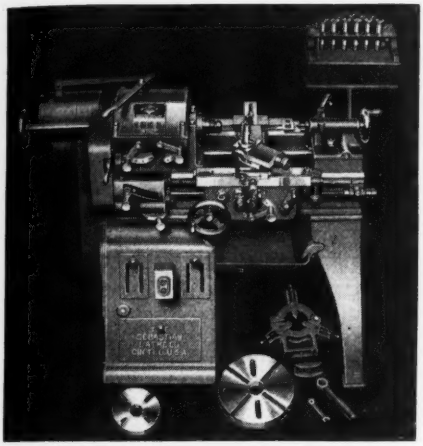

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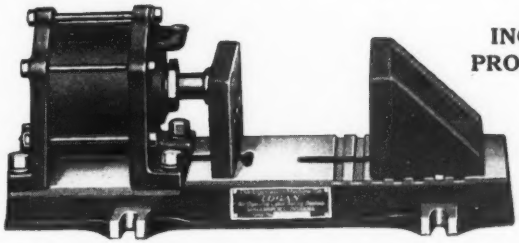

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Some Common Errors in Jig and Fixture Design

By R. H. KASPER

THOUGH the tool engineer may have no difficulty in designing jigs and fixtures for the ordinary run of work, there are a few essential details which are often overlooked. This is

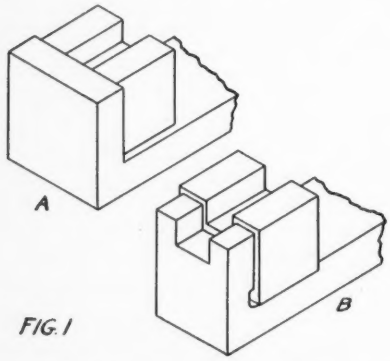

FIG. 1

more especially true in the shop where only an occasional jig is used, or when only a comparatively small number of parts are to be machined.

In such cases, the design of the jig is controlled largely by the cost; it is made up quickly and cheaply, and its deficiencies are usually not discovered until the job has been completed, when it is found that some of the parts are acceptable while others will require "doctoring" before they will pass muster. In this discussion, the study of jig and fixture design will not be entered into deeply; the object is to point out only the most common points of error, most of which could be avoided at little or no added expense.

One common error is failure to provide for the burrs which may be set up by a previous operation. The writer has a job in mind on which the first operation was that of milling, after which the burrs were to be removed in preparation for the next operation. But the designer of the jig for the next operation had failed to consider the possibility of some of the burrs being missed. That is exactly what happened; the boy assigned to the job became fatigued with the monotony of the work and failed to remove all of the burrs. The result was spoiled work.

Whenever possible, the jig should be designed with the thought in mind that some of the burrs may be left on, and clearance should be provided accordingly. In designing the jig shown at *A*, Fig. 1, the designer has given no thought to the possibility of burrs being left on by the previous milling operation. At *B*, in the same illustration, provision has been made for the possibility of burrs being left on and, in addition, the locating surface has been designed so that the

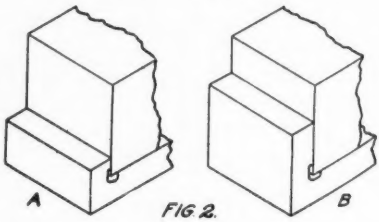

FIG. 2.

edge of the work does not touch it at any point. This latter point is frequently very important, as a burr or nick on the edge or corner of the work, caused by careless handling,

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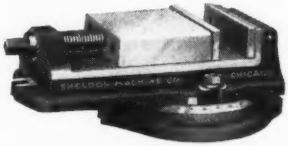

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4	4½"	1⅝"	3½"	30	$20.00	45	$24.00
6	6½"	2 "	4½"	70	$30.00	90	$40.00
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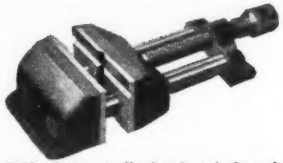

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D 6	6½"	1¾"	3½"	6"	35	$18.00
D 9	9 "	2½"	4½"	9"	70	$24.00

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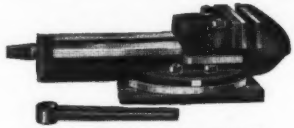

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*Distance between holes can be changed without additional charge.

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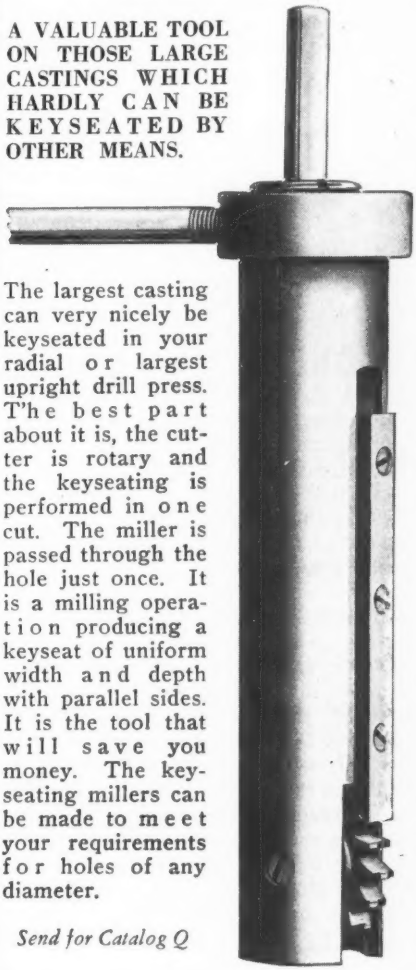

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may affect the location of the work sufficiently to render it useless.

In connection with the latter point, it is best, whenever possible, to locate the work for each operation so that as many as possible of the burrs which must be removed are thrown on the same side, as it will greatly

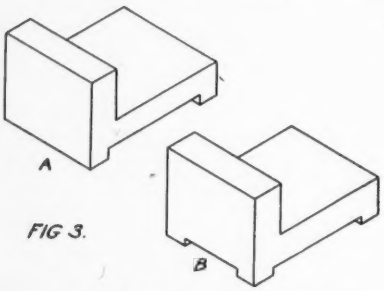

FIG 3.

reduce the time required for their removal.

Another common error consists in having the locating surfaces too large. In the case indicated at *A*, Fig. 2, the work will be located just as effectively as that shown at *B*, assuming that the thrust of the operation will be downward, and without any tendency to tip the work. If the work must be supported at a high point, it is much better to support it against two narrow vertical or horizontal ribs. The smaller the locating surfaces, the less will be the danger of chips being clamped between the locating surfaces and the work.

When the cost of a drill jig must be considered, it is common practice to provide merely a flat resting surface. This is usually satisfactory providing the jig is intended to remain fixed in position on the table of the machine. If the jig is removable, however, accurate work cannot be expected, as it is practically impossible to keep a large surface clear of chips at all times.

It is much better practice to provide narrow lugs as resting points, as shown in Fig. 3 at *A*, or better still, four pads as shown at *B*. There should always be four pads; never three. Jigs are sometimes made with three pads in order to allow them to rest more firmly on the machine-table, which is a good point. But if a chip lodges under one of the three pads, it may not be detected, whereas the rocking of a four-pad jig readily indicates to the operator that there is a chip under one of the pads. The pads should be kept as small as consistent with wearing properties, but they should never be small enough to drop into the slots in the machine-table.

Grooves for dirt and chips are usually provided in internal corners, but they are often made too small, or incorrectly designed. For example, the grooves shown at *A* and *B*, Fig. 4, provide clearance for the chips, but only if the chips happen to fall in a certain position. In the case shown,

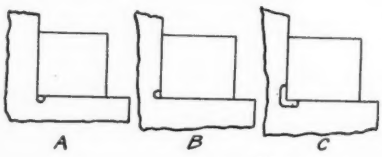

FIG 4.

it is still possible for a chip to lie partly in the groove and partly on the locating surface. Chip grooves should be of ample proportions, and should provide clearance for both working surfaces, as shown at *C*.

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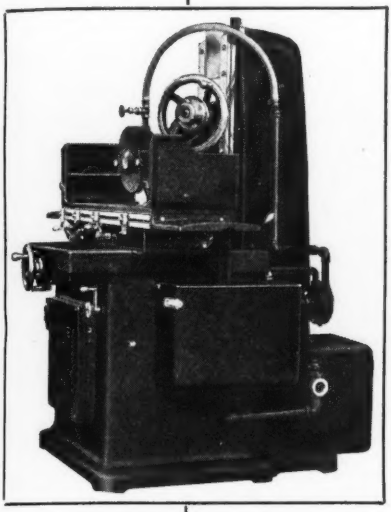

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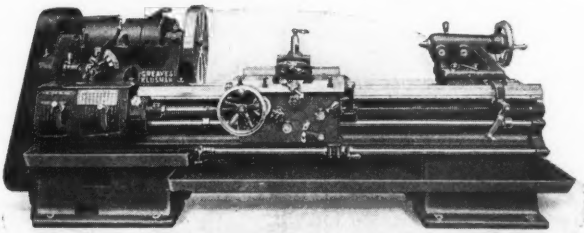

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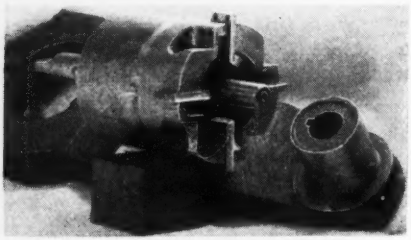
Turning Eccentric Crank Arm Boss

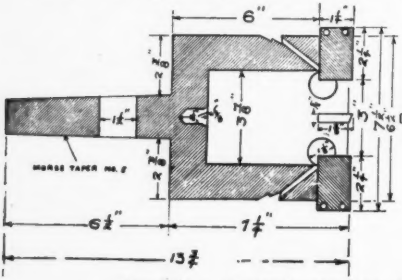
By J. H. HAHN

THE tool shown in the accompanying illustration is used in our shop to turn the bosses on eccentric crank arms. Various methods of doing this



Tool for turning eccentric crank arm boss.

job are emloyed in different shops, some using a boring mill, others performing the operation in the lathe.



Dimensions of crank arm boss tool.

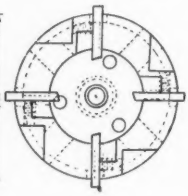
Our experience has been that with the tool shown we can turn out the job on a drill press in about one-third the time required when other machines are used.

The four cutters are set to a plug gauge of the diameter of the finished boss. The eccentric crank arm is clamped to the drill press table, directly under the spindle, so that the pilot on the tool will fit into the hole in the center of the boss on the crank arm. The tool is then fed down over the boss, producing a very satisfactory and accurate job.

Two Handy Milling Fixtures

By H. L. WHEELER

TWO handy fixtures which can be utilized for either manufacturing or jobbing work on such operations as milling the ends of shafts, keyseating, drilling, and so on, are shown in Figs. 1 and 2. The fixtures are of simple and inexpensive design, and can be used to advantage on many different types of machines, as they can be set up quickly for short operation work.



The base of the fixture, Fig. 1, is of cast iron, with a V planed on the upper side and a key slot, parallel with the V, on the bottom. The plunger, which is made of steel, slides through a hole bored in the cylindrical section of the casting, where it is held from turning by a key. A square is cut on the upper end of the operating screw to fit one of the machine handles, and

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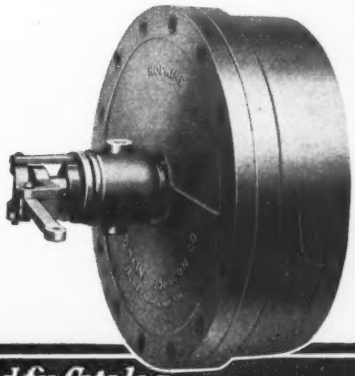

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the point of the plunger, at the lower end of the screw, is rounded to prevent marring of finished work. The plunger can be made of tool steel and

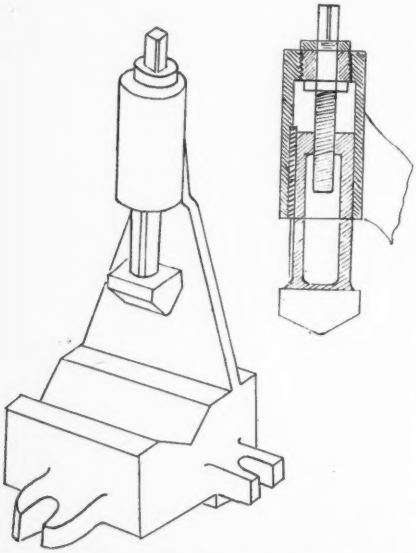

Fig. 1—Fixture for holding cylindrical parts.

hardened on the point, or case hardened if made of machine steel. One of these fixtures left set up on a hand miller will save many hours in the tool room.

The fixture shown in Fig. 2 is equally efficient, but is more adaptable for small diameters and light work.

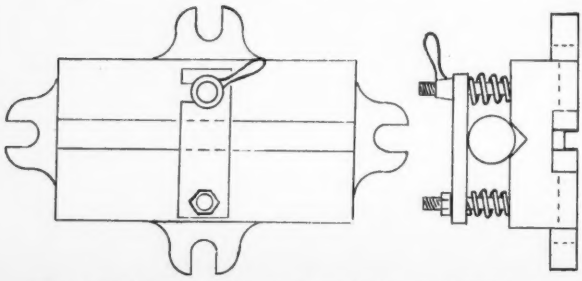

Fig. 2—This fixture is more adaptable for small work.

The base is made of cast iron or steel, and is provided with a key which engages the T-slot in the machine-table. The work is held in place by a binding strap of steel, which is locked by means of a handle nut, the strap being slotted on one side so that it can be swung out of the way for loading. Coil springs support the strap on either side. Both of these fixtures should have slots in the bottom at right angles so that they can be used in either of two positions.

Templet For Milling Keyways

By CHARLES KUGLER

THE job of milling keyways in a shaft at an angle to each other is a simple matter when a special fixture is used, or when the work can be held between the centers of a dividing head. Otherwise the mechanic may find it difficult to obtain the necessary accuracy.

The writer had a number of shafts, each six feet long by three inches diameter, in which several keyways were to be milled at given angles to each other. The operation was easily performed with the aid of a "pantograph," which consisted of a piece of 1/16-inch sheet brass twelve inches square. The brass piece was laid out and the lines were inscribed on it at the required angle, as shown in the illustration, then the center of the piece was bored for a snug fit on the shaft. A surface gauge was used to set each line, in turn, parallel with the machine-table.

As the lines were twelve inches or more in length, and the diameter of the shaft was only three inches,

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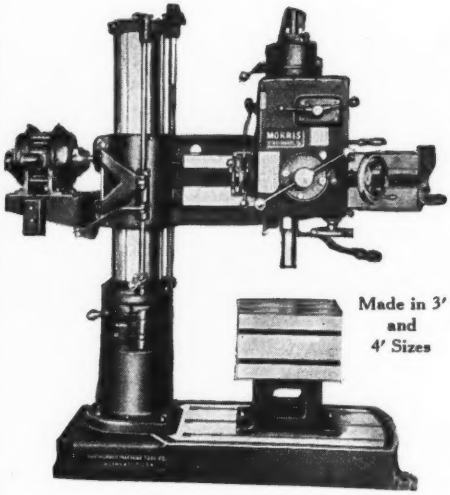

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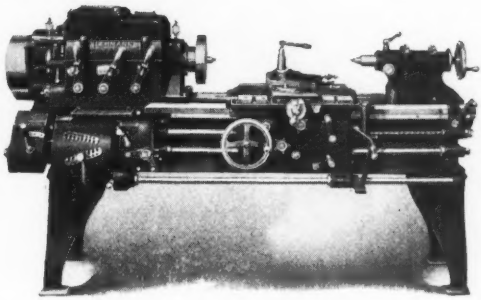

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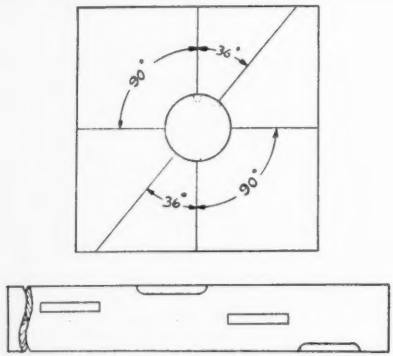


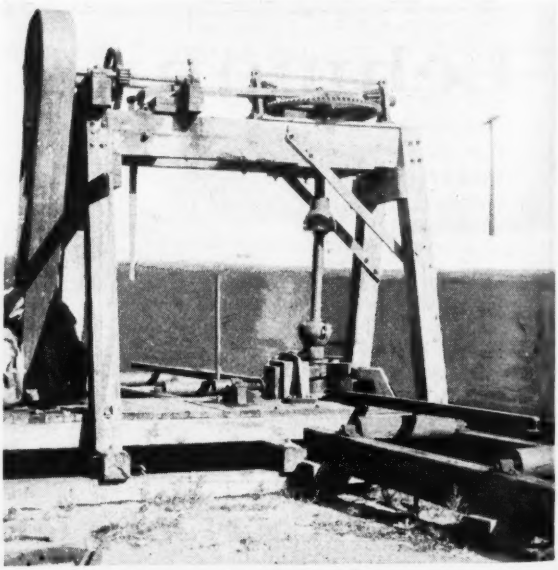
(Above) — Pantagraph, with lines inscribed. (Below)—Shaft, showing location of keyways.

the operation was extremely accurate. This method also saved a great deal of time, as otherwise each shaft would have had to be laid out.

Power-Driven Rail Bender

By Jos. C. Coyle

THE rail-bending machine shown here is in use at the Denver shops of the Denver & Salt Lake Railroad, both for straightening and for curving steel rails. The machine consists primarily of three heavy vertical rollers which are shaped to fit the channel of the rail. Power is supplied to one of the rolls from an electric motor which drives a set of shafting that is geared down to obtain the necessary power. The vertical shaft is mounted between two strong ball and socket joints which make it possible to move the live roll back and forth, as required. The live roll is hung on bearings in a housing that is controlled by means of a heavy horizontal feed screw. The operation of turning the screw forces the live roll against the rail so that it is given the desired curve as it passes between the rolls. The rail is supported at either end by metal idlers, as shown.



Bending rails in a power-driven machine.

Apex Friction Chuck Catalog

A catalog that describes and illustrates the Apex Friction Chuck, and tells how the chuck is used to prevent breakage of taps, reamers, drills, and other tools, has just been issued by The Apex Machine Co., 200 Davis Avenue, Dayton, Ohio. The catalog also describes the use of the chuck for setting studs and nuts, and tells how the chuck will prevent the breaking of taps in multiple spindle tapping. Free on request.

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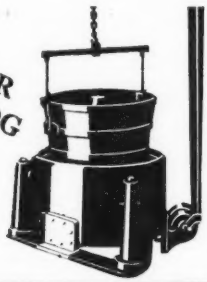

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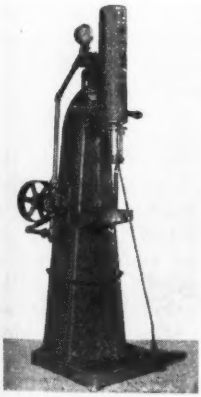


The American 2-Ton Hydraulic Press

is recommended for broaching connecting rods and work that comes within the 2-ton range. We manufacture presses from 2 tons to 150 tons pressure, also all types of broaching tools.

AMERICAN BROACH & MACHINE CO.
ANN ARBOR, MICHIGAN

THEY make any buffing operation smooth and continuous without loss of time. They eliminate all disadvantages of rag-buffs. They speed output, do better work and cut costs in half. Removal and attachment of abrasive cloth takes only 30 seconds. Entire assembly delicately balanced, preventing chattering. Every square inch of buffing surface brought into action.

Absolutely safe at high speeds. Tested at 8,000 R. P. M. and thoroughly guaranteed. A special feature is our patented metal clip which holds the ends of abrasive strips together, permitting speedy application and allowing ten per cent saving of material. Adopted by hundreds of factories all over the country for economy, safety and speed.

Write For Complete Details

This buffing system quickly pays for itself. Write immediately for bulletin and prices. Investigate this remarkable buffing system without delay.

C. B. HUNT & SON

639 McKinley Ave., Salem, Ohio

MODERN Machine Shop

Published Monthly at
128 Opera Place, Cincinnati, Ohio
By
DON G. GARDNER - - - - *Publisher*
HOWARD CAMPBELL - - - - *Editor*

Co-operation Pays

THEODORE ROOSEVELT once said something to the effect that "every man owes it to his trade or profession to contribute something to the upbuilding of that profession." The young apprentice or student of today who is penetrating the mysteries of his chosen craft is receiving the benefits that have accrued from the experiences of thousands who have gone before him. The tools that he uses, the machines upon which he receives his training, the lessons that are taught him in the classroom—all these are the crystallized ideas of generations of mechanics and engineers who have trod the same path when it was, perhaps, nothing more than a blazed trail.

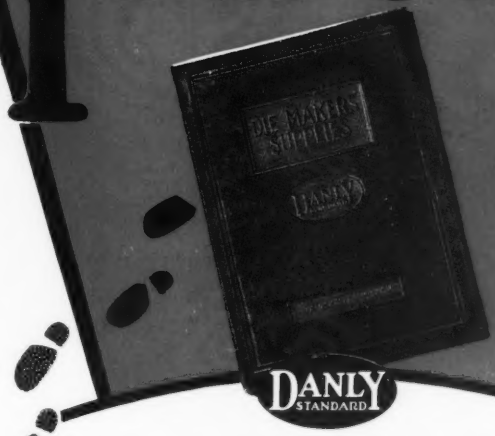
One of the most practical ways of serving one's profession is through co-operation with others who are engaged in the same line of endeavor. And co-operation is not, by any means, a one-sided proposition.

In the early days of the automotive industry, each of the few manufacturers who was then in business was striving desperately to develop a motor—a body design—anything—that would give him the lead over his competitors, and each was afraid that the others would discover his secrets. The industry was stumbling along. Then the automotive engineers got together and started comparing notes. Today the automotive industry is the marvel of the age, insofar as efficiency in manufacturing is concerned.

Fifteen years ago there were many locomotive repair shops in which a micrometer had never been seen, although a sort of tradition had grown up, through the years, that the only real mechanics were railway shop mechanics. And then suddenly the mechanical executives discovered that they had been standing still while the rest of the industrial world had been progressing. Immediately arrangements were made for special trips for the executives and every effort was made to learn what was being done with new machines, new tools, and new methods. Be it said to their credit that, as a result of co-operation and the periodical exchange of ideas, the railway shops of this country have again taken their place in the front ranks as a highly efficient industry.

Not alone within the bounds of one's own class of operations will the best ideas necessarily be found. The methods used by an automobile manufacturer may be adapted to the production of machine tools; a builder of machine tools may teach one of his clients among the railway shops how to grind cutters; a system that is in successful operation in a railroad shop may be used to advantage in a jobbing or contract shop. How fine it would be if each machine shop executive could travel around and see the interesting features of all the other shops in the country. Obviously this is impossible, but it is not impossible for the editor of such a magazine as MODERN MACHINE SHOP to gather this material and present it to the industry through the pages of his journal. The performance of this task brings about an exchange of ideas which promotes the development of the industry, and provides an opportunity for each successful engineer and mechanical executive to contribute something to the welfare and upbuilding of his profession.

Your Copy



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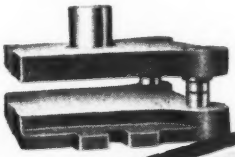

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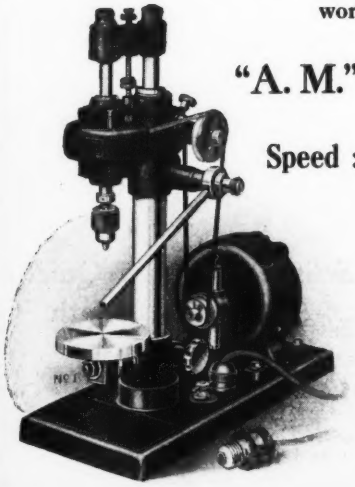

work where quality and accuracy are the first consideration, the

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Speed :: Accuracy :: Rigidity :: Durability

We will send this machine to any responsible firm for

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Send blueprint or sample so that we can determine size of machine desired. If not adaptable to the work, it may be returned at our expense.

Ask us for "An Outline of Economical Small Drilling"

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Fifth and Elm Sts., S. E., Cincinnati, O.

COOLANT PUMPS

Reduce Machine Tool Operating Costs

By supplying a steady flow of coolant to the cutting tools on metal working machines. TRAHERN Rotary Gear Pumps are a direct factor in eliminating interruption in machine operation and in increasing the productive capacity of a shop. One way or reversible types—with or without automatic built-in relief valve — capacities range from 1¾ to 20 G. P. M. A type for every machine. Write for catalog 54.

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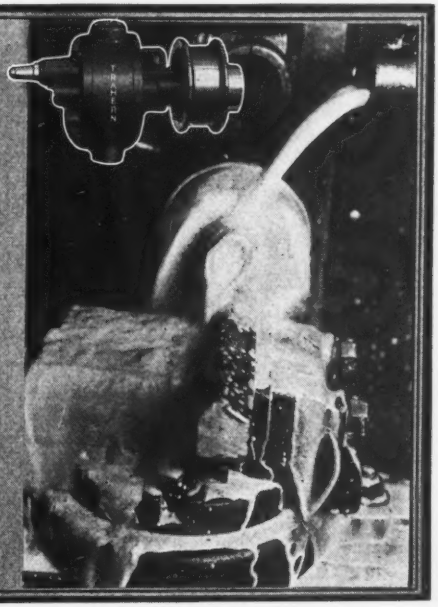
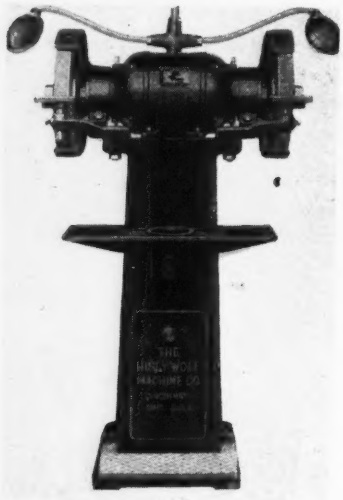


New Shop Equipment

"Hisey" Automatic Grinder Lights

The illustration shows a "Hisey" floor grinder, equipped with Hisey automatic grinder lights. The lights are arranged with one over each wheel, in such position that the light will be thrown on the wheel, where it is wanted, but will not interfere with the efficient grinding of the tool. The feature of the lighting equipment is the switch, which is operated by the foot of the operator while he is standing in the normal grinding position. The switch controls the operation of the wheel also, so that as the



Hisey Floor Grinder equipped with "Hisey" Automatic Grinder Lights

operator leaves the machine, taking his foot off the switch, the current is shut off, stopping the motor and shutting off the lights simultaneously. The lights can be instantly adjusted to suit the operator, and push-button control can be furnished if the customer does not want the foot treadle switch.

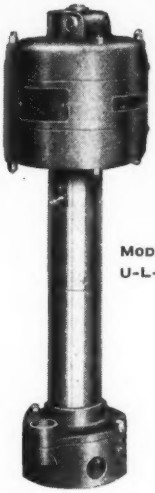
Eclipse Improved Quick-Adjustable-Length Holder

The Eclipse Interchangeable Counterbore Company, 7410 St. Aubin Street, Detroit, Mich., announces a new and improved type of extension holder which is particularly adapted for multiple spindle spotfacing, counterboring, countersinking, or core drilling to specified depths. The improved Eclipse holder is adjusted by hand, the adjustment being accomplished by lifting the knurled locking collar, revolving the body of the shank to the proper length and then re-engaging the knurled collar with the upper part of the body.

The photograph shows four illustrations, the two outside views showing one type of Eclipse improved holder assembled and disassembled This particular type has a ratchet adjustment by means of which it is possible to secure variations in length of .004 inch by moving the collar one notch. This type, known as the "R" type, can be used only in a right-hand direction. The two center illustrations show the "SD" type, the collar of which has square driving lugs, making it useable for driving either right or left hand. The adjustment obtainable with this type of holder is about .008 inch.

The extreme simplicity of the Eclipse Improved Quick-Adjustable-

"GUSHER"
Coolant Pumps

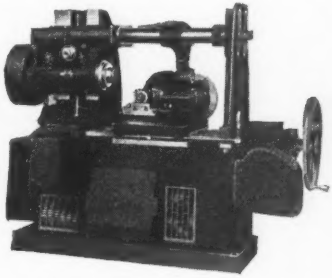


are built to outlast the machines they serve

Simplicity in construction gives "Gusher" pumps longer life, greater strength, smoother performance, and greater economy in operation. .

The Ruthman Machinery Co.
Front and Pike Streets
CINCINNATI

SERVICE *Is Our Motto* QUALITY *Our Creed*

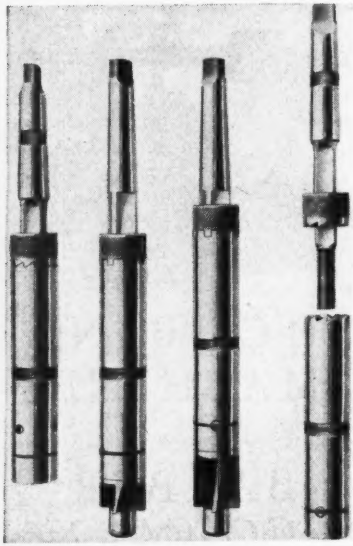


HOBBING MACHINES
by
BARBER-COLMAN
of ROCKFORD

3 SIZES of Hobbing Machines... all of them capable of making spur and spiral gears, sprockets, ratchets and splined shafts..."universal" type...excellent equipment for the up-to-date manufacturer or machine shop ...Send for our circulars.

BARBER-COLMAN COMPANY
General Offices and Plant—Rockford, Ill., U. S. A.

Length Holder is apparent. The tool consists of an accurately ground square shank, the corners of which



Eclipse Improved Quick-Adjustable-Length Holder

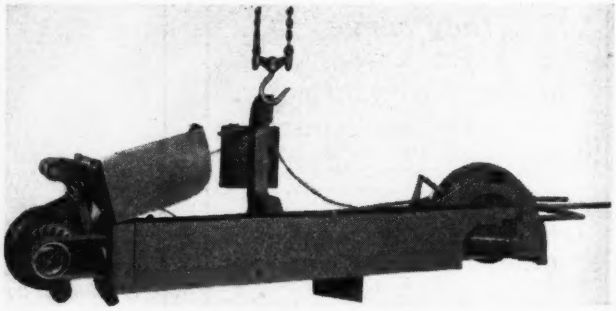
are cylindrically - ground, affording ample bearing for accurate alignment. A fine-thread tip is provided for fine adjustments, with a sliding collar having a square broached hole with driving lugs for engagement with the body, and a sleeve into which the shank bears. The hole in the sleeve is, of course, ground in alignment with the hole at the bottom of the sleeve which receives the cutting tool.

In cases where the holder is to be used in a horizontal position, a set screw has been provided in the collar to maintain positive engagement. In the usual vertical position however, gravity keeps the collar in engagement, excepting when lifted by hand. With the locking collar located at the upper end of the holder body, the tool is particularly adapted for guiding in a fixture bushing, due to the long bearing surface, in which oil-grooves can be milled if desired.

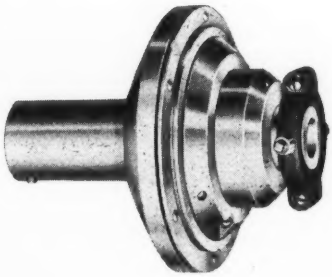
"Safety" Portable Grinder

The Safety Grinding Wheel & Machine Co., Springfield, Ohio, has developed the "Safety" Portable Grinder shown in the illustration. The machine is intended for use while suspended and can be rolled to 90 degrees in either direction, making it possible to use the face of the wheel against a vertical surface from either side.

This machine is particularly adapted for high speed service, and is equipped with a very heavy fan-cooled motor. As it is imperative that a machine using high-speed wheels be designed to maintain the correct speed at all times, the machine is equipped with an interlock between the wheel diameter and the rotative wheel speed. This is accomplished through a system of changeable pulleys whereby the pulley change can be made very quickly, but cannot be made at such a point in the wheel diameter as would permit of over-speeding of the wheel. It is assumed that a constant-speed motor will be used rather than



"Safety" Portable Grinder



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is a husky, simple, attractive full floating plate clutch, with all the features of any other clutches and the following to boot:—

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Centripetal Action
Under-slung Actuators
Large Lever Ratio
One Point, Accurate Adjustment
Easy Engagement
Instant Release
Drag-free Idling
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Pick one out of Bulletin DC and buy it—your clutch problems will then be over.

The Conway Clutch Co.
1959 W. 6th St., Cincinnati, Ohio

"It is a splendid Clutch."

Better Grinding at *LOWER* Cost

WHETHER you do precision or rough grinding, Safety abrasive wheels can save you time and money. They will increase production, cut labor costs and give you a bigger profit on every job.

Our experts are at your service

Our men are willing and able to go right into your shop, analyze conditions, and suggest abrasives and equipment which will give you the best results. Further than that, while our grinding wheels are in use an accurate record of the work they do is checked carefully . . . compared with similar cases. For we are not satisfied until these wheels are actually paying for themselves through increased production and reduced operating costs.

Start NOW to get those extra profits

We will be glad to send one of our experts to you, if you say the word. He will point out how *you*, too, can improve production with "Safety" Grinding Equipment. Write today and let us know when it will be convenient for him to call. This, of course, will not place you under any obligation. Also get complete information and specifications on our grinding wheels and grinding machinery. You should have it in your reference file.

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SAFETY

THE SAFETY GRINDING WHEEL & MACHINE COMPANY
Springfield, Ohio

GRINDING WHEELS

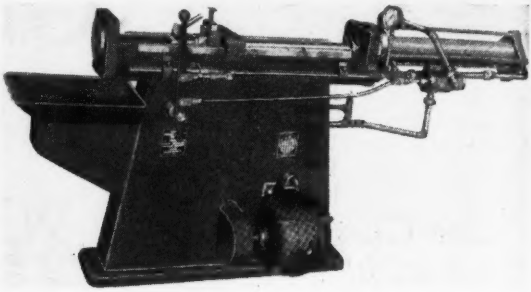
Use our **"Rex"** Wheels on metals of high tensile strength and tough fibre. **"Corex"** Wheels give best results on low tensile metals of brittle structure. And our new **"Safe-T-Bond"** Wheels are giving unequaled results on high-speed grinding. You should know about them. Send for the information

one of the variable speed type, as the former is recommended.

The machine shown is adapted for wheels of 24-inch diameter, with 3-inch face and 12-inch hole. Any size hole from 2 inches up can be provided for, as required. When necessary to change the speed, the belt guard is opened as shown in the illustration, and is afterward lowered into place and latched.

"American" No. 0 Horizontal Hydraulic Broaching Machine

The American Broach & Machine Company, Ann Arbor, Mich., is now building a No. 0 horizontal hydraulic broaching machine to handle broaches up to 30 inches long. The unit is provided with automatic stops for any desired stroke. The sliding head has a vertical adjustment of 1½ inches either above or below the center. Capacity for pull is two tons. The machine is for motor drive only, the pump being driven by a silent chain. Ram movement is controlled by a balanced piston valve, with a relief valve in the line to limit the maximum pressure, which is normally at 350 pounds per square inch.



"American" No. 0 Horizontal Hydraulic Broaching Machine

The speed of the pulling ram is 18 feet per minute with the pump driven at 600 r. p. m., but this can be changed

Keep the Light and the Lamp Where Each Belongs

HERE are directed light and protected lamps in one. The heavy wire guard protects the lamp from breakage and unauthorized removal; the metal reflector puts the light right on the work and protects the workman from the eye-fatiguing, blinding glare of a bare lamp.

Let us send you a sample or get one at your nearest electrical dealer.

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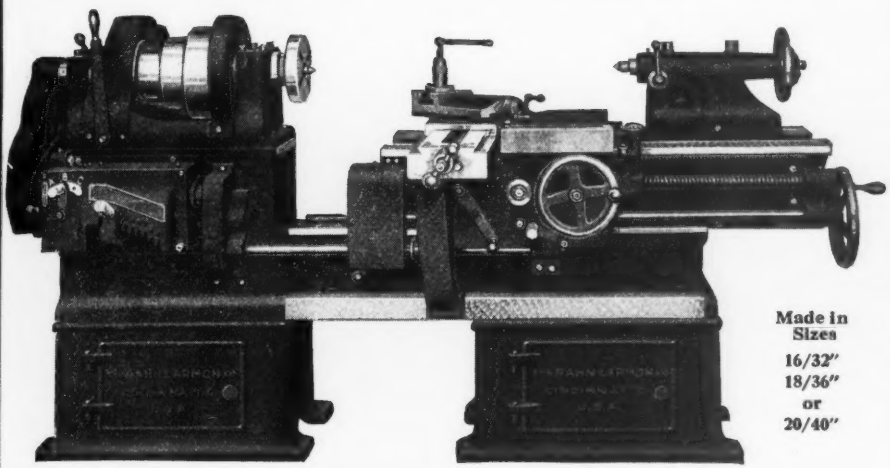
VALPARAISO, IND.



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16/32"
18/36"
or
20/40"

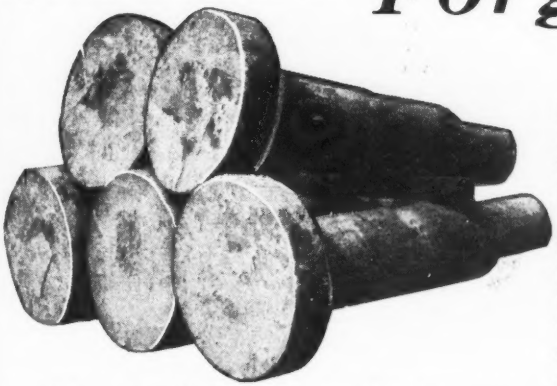
Rahn-Larmon 18/36" Extension Bed Gap Lathe

A lathe for large or small swing work, ready at all times. Requires no extra rigging up. Takes different distances between centers.

Belt driven or with nine speed all geared motor driven head. Tell us what your requirements are and let us quote you.

THE RAHN-LARMON CO. **2935 Spring Grove Ave., Cincinnati, Ohio**

Special Hammered *Forgings*



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Forging, like any other manufacturing, requires facilities. We have all the necessary forging and rough turning facilities plus a personnel of thoroughly experienced hammersmiths. Thus, we are able not only to make any forgings you want but we are also able to make them within the time you specify. Why not ask us for an estimate?

THE STEEL FORGINGS COMPANY, CINCINNATI, OHIO

to suit the work. A two horsepower, 1,800 r. p. m. motor is recommended. A five gallon oil tank is built into the base of the machine, a medium grade of cylinder oil being suggested. The floor space is 4 x 9 feet and the approximate weight is 1,400 pounds.

Angle Steel Machine Tender

One of the most practical of items for general machine shop usage, and one that will pay its own way in time and effort saved, is the No. 218-DC Machine Tender or tool stand put out by the Angle Steel Stool Company, of Plainwell, Mich. Entirely built of steel, riveted construction, this tender will withstand rough usage and hard service.

Angle Steel Machine Tender

The size is 24 inches wide by 18 inches deep by 35 inches high, with drawer 21⅜ inches by 17 inches by 3½ inches inside measure, equipped with lock. It is constructed of 16-gauge with 1¼-inch angle legs, and mounted on steel wheel 2-inch swivel casters.

This machine tender may be used alongside a machine, or may be easily moved by the mechanic from one job to another.

A marked saving in wheel and diamond wear is effected by the proper balancing of the wheel, as a wheel in good balance requires a minimum of truing. It is impossible to obtain an absolutely true face on a wheel that is badly out of balance, and without a true face, accurate work and a good finish can not be obtained.

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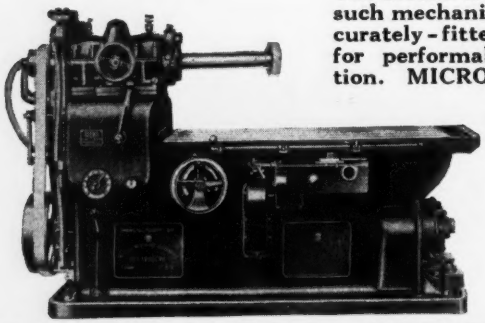
SPEED and ACCURACY are characteristics of the successful grinder. The first is necessary to maintain production schedules and keep costs down. The second is essential in the building of all such mechanical products as depend on accurately-fitted and smooth-running parts for performability and customer satisfaction. MICRO Internal Grinders in your shop will bring you these results in liberal measure. Write for full information.



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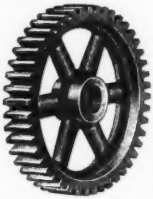

GEARS

All Kinds—Small—In Stock

The most accurate made and prices reasonable. We carry a complete line of gears in stock for immediate shipment. Can also quote on special gears of all kinds. Send us your inquiries.

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LUFKIN

"RAPID READING" MICROMETERS

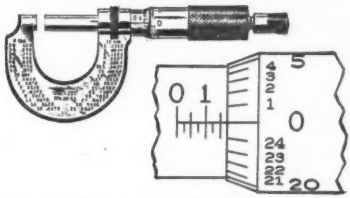


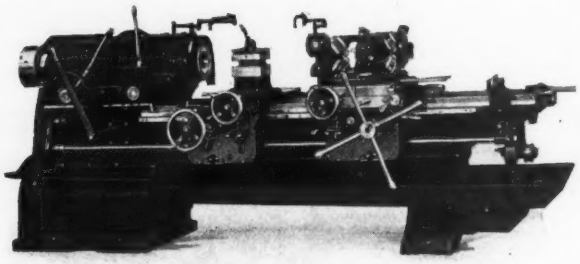
Illustration shows new method of marking the sleeve; every thousandth numbered. It makes reading quicker, easier, and more positive.

Ask your tool dealer to see them
Send for Catalog No. 3

THE LUFKIN RULE CO.
SAGINAW, MICH.

No. 3 Acme Heavy Type Universal Turret Lathe with DUO CONTROL

Higher operating efficiency, together with simplified design, makes this Acme Turret Lathe an unequalled producer on all work within range.



DUO CONTROL Lathes Built in These Sizes

No. 1—Semi- and Full Universal, 2½" capacity.

No. 2—Semi- and Full Universal, 3¼" capacity.

No. 3—Semi- and Full Universal, 3½" spindle capacity.

17" and 4½" Semi- and Full Universal, 4½" spindle capacity.

THE ACME MACHINE TOOL CO., Cincinnati, Ohio

"We read it from cover to cover"

Says DON HEYER, President of Heyer & Sutton, Inc., machinery builders of Hollywood, California. He writes: *"We like the many articles on shop practice and especially the ones describing various manufacturing operations, such as the article on the Velie Aircraft Motor, and the article in this month's magazine on the Scully-Jones products and Dayton Steel Wheels. We read it from cover to cover and would not miss out on any of the sections of the magazine."*

Don't you like to have "the old man" come along once in a while and slap you on the back and tell you that you are doing a good job? So do we—and our readers are "the old man." We are getting letters like the above every day, so it is easy to see why we are growing bigger and better each month.

MODERN MACHINE SHOP *will be sent to any machine shop executive — without charge!*

Correct any errors in your name, title, or address, and return to

MODERN MACHINE SHOP
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Name.....Title.....
Firm.....
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City..... State.....
Remarks: .....
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This ANDERSON HAND SCRAPER

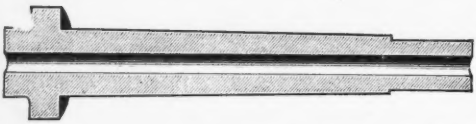
will be sent to you for **10 DAYS' FREE TRIAL!**

Don't waste time making your own. The blades are of just the right hardness. Cuts faster and lasts longer than any home-made scraper.

Price per doz., ¾", $26.00; 1", $27.00; 1¼", $28.00. ***Let us send you one on trial.***

ANDERSON BROS. MFG. CO. 1926 Kishwaukee St., Rockford, Ill

Save Money on Hollow Bored Forgings



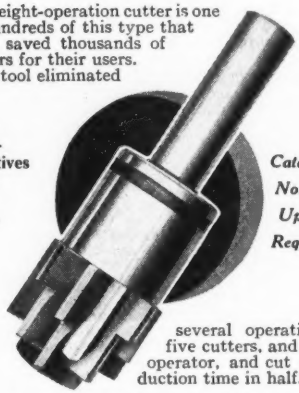
Or on Steel Shafts for Lathe Spindles, Piston Rods, Rams, Clutch Shafts, Hydraulic Cylinders, etc., by specifying "AMERICAN." Uniformly excellent quality, close approach to finished dimensions, fair prices and prompt delivery are some of the reasons for the satisfaction experienced by users of American Hollow Bored Forgings.

SEND US BLUEPRINTS FOR ESTIMATE

AMERICAN HOLLOW BORING COMPANY, 1035 W. 19th St., Erie, Pa.

Multi-Diameter Cutter

This eight-operation cutter is one of hundreds of this type that have saved thousands of dollars for their users. This tool eliminated several operations, five cutters, and one operator, and cut production time in half.



Sales representatives in all large cities.

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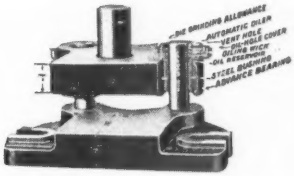

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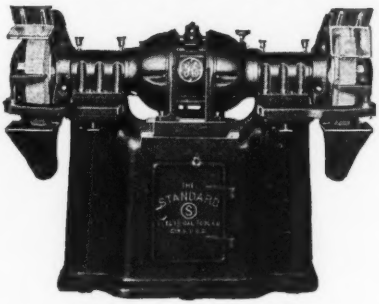

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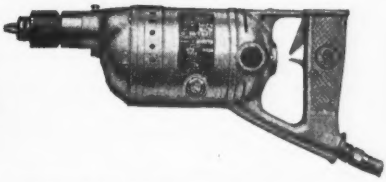

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Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Turret Lathes and Tools: Illustrated book describing Cincinnati Acme Turret Lathes and Screw Machines, and showing a variety of tools and fixtures for use with these machines. The Acme Machine Tool Co., 4935 Spring Grove Ave., Cincinnati, Ohio.

Broaching By Modern Methods: Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

Bowsher Balancing Way: Gears, pulleys, fly-wheels, emery wheels, and other rotating parts should be properly balanced. This work can be done quickly and accurately on a balancing way that is described in a bulletin issued by The N. P. Bowsher Co., South Bend, Indiana.

Bradford Unit Type Drill Heads and Tapping Heads are described and illustrated in a bulletin published by the Bradford Machine Tool Co., 659 Evans Street, Cincinnati, Ohio. The bulletin also describes useful applications of these heads.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

B. & S. Catalog No. 138: This book contains complete descriptions and illustrations of the milling machines, grinding machines, tool and surface grinders, automatic gear cuttings machines, automatic screw machines, milling attachments, screw machine attachments and tools, end, side, and inserted tooth milling cutters, gear hobs, micrometers, calipers, squares, bevel protractors, vernier height gauges, dial gauges, wire, thread and drill gauges, and other machines and tools manufactured by the Brown & Sharpe Manfg. Co., Providence, R. I. Sent free upon request.

Gears of All Kinds are described and illustrated, with specifications, in Catalog 80 which has been issued by the Chicago Stock Gear Works, 105-9 S. Jefferson St., Chicago, Ill. Copy sent free on request.

Drilling Machinery: Circulars describing all types and sizes of radials, uprights, and gang drills for every class of work may be had by writing to The Cincinnati Bickford Tool Co., Oakwood, Cincinnati, Ohio.

Gear Data: The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various types and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also includes a number of pages of valuable data and reference tables for machine shop use.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Shaper Progress: An illustrated catalog describing the various types of shapers made by the Cincinnati Shaper Co., Cincinnati, Ohio, and including descriptions of Cincinnati Shapers in use in different kinds of plants.

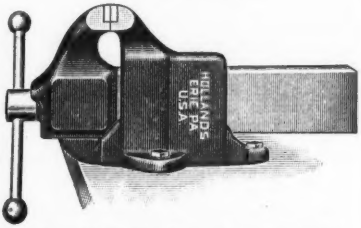
Cisco Engine and Tool Room Lathes, manufactured by the Cisco Machine Tool Co., 1765-69 Elmore St., Cincinnati, Ohio, are fully described in their catalog. This catalog also includes descriptions of their Radial Drill, Tapping Machine, and Special Attachments.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Inserted Blade Reamers: A new type of reamer with high speed steel blades, designed to reduce cutting costs and give longer service, is described in a bulletin that will be sent without charge upon application to the Conradson Tool Corporation, 2114 Indiana Ave., Chicago, Ill.

OTHER PUBLICATIONS LISTED ON PAGES 72 AND 74.

HOLLANDS VISES



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Strenth, rigidity and durability are the three qualifications that have been attained by good design, workmanship and manufacturing facilities.

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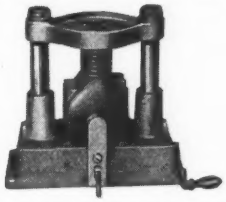
—speeds production schedules where SIEWEK JIGS are used



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SIEWEK DRILL JIGS permit extra fast operation, drilling several parts in one jig, drilling right and left hand parts in the same jig.

Write today for details of the new SIEWEK Rapid Drill Jigs. They're money savers!

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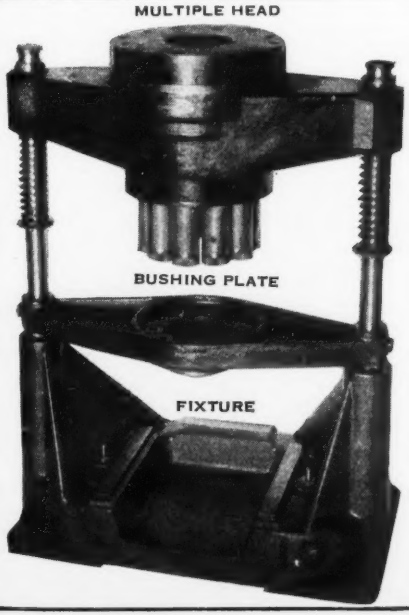

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Drilling, Reaming, Boring, Tapping

OUR SKILLED TOOL ENGINEERS

Will be pleased to furnish complete data and submit quotations on the equipment best suited to your purpose.

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Disc, Expansion and Compression Clutches: The various types of clutches and their uses are discussed in an illustrated booklet that is issued by The Conway Clutch Co., 1959 West Sixth Street, Cincinnati, Ohio.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Quantity Drilling: A semi-automatic multiple spindle drilling machine which is designed to produce the maximum of drilled holes in medium or small parts, is described in a pamphlet that is published by the Detroit Machine Tool Co., 5055 Woodward Ave., Detroit, Michigan. Sent free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Interchangeable Counterbore Co., 7410 St. Aubin St., Detroit, Michigan, describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Modern Grinding Equipment: The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Gallmeyer & Livingston Co., 336 Straight St., S. W., Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

Saving Time by Disc Grinding: A book that tells how production costs can be reduced by the use of modern disc-grinding equipment, and which describes and illustrates the latest types of machines used for this work, has been issued by the Gardner Machine Company, Beloit, Wis. A number of illustrations of jobs in operation, together with complete production data, are included.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

Vises and Pipe Tools: The bench, machine and pipe vises, pipe cutting and threading tools, babbitt ladles and melting pots made by the Hollands Manufacturing Co., 344 E. 18th St., Erie, Pa., are described and illustrated in a booklet that is issued free by the firm mentioned.

"Quick-As-Wink" Buffing Wheels that eliminate all disadvantages of rag-buffs, speed output, do better work, and cut buffing costs to the minimum are described in a bulletin that is issued free by C. B. Hunt & Son, 639 McKinley Ave., Salem, Ohio.

Special Mil-Waukee-Mils of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

Standardized Jigs and Fixtures: Information concerning standardized jigs and fixtures, also all kinds of special equipment for production, can be had by writing to H. R. Krueger & Co., 439 East Fort St., Detroit, Mich.

Cutter and Tool Grinding: A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

Lehmann Lathes: Details of the outstanding features of Lehmann Lathes are given in a catalog published by the Lehmann Machine Co., 3560 Chouteau Ave., St. Louis.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Lamp Guards: The various types and kinds of lamp guards made by the McGill Manufacturing Co., Valparaiso, Ind., for factory use are described in a catalog that will be sent free upon request.

Accuracy in Internal Grinding: The latest methods of producing accurately-ground holes are described in a booklet which also describes and illustrates the internal grinders made by the Micro Machine Co., Bettendorf, Iowa. Sent free upon request.

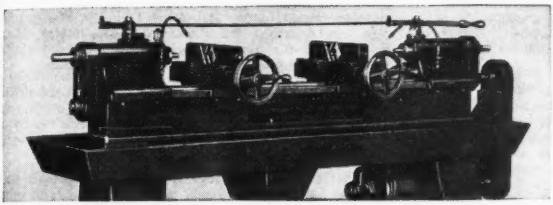
Roller Bearing Radial Drills: The application of Timken roller bearings in the design of modern radial drilling machines is discussed in a bulletin describing "Mor"-Speed Radial Drills, published by the Morris Machine Tool Co., Cincinnati, Ohio.

An Outline of Economical Small Drilling: The subject of small-hole drilling is discussed in a booklet that is published by Adolph Muehlmatt, Fifth and Elm Sts., S. E., Cincinnati, Ohio. The booklet also describes the outstanding features in the construction of the A. M. Sensitive Drilling Machine.

"The 'Hole' Story In One Word" is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Natco" multiple drilling and tapping machines.

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

OTHER PUBLICATIONS LISTED ON PAGES 70 AND 74.



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For centering both ends of a shaft simultaneously. Spindles operate together or independently. L. H. head is removable for long shafts. Accommodates a wide variety of work. Special fixtures furnished when desired. Send for Bulletin.

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Diamond Nibs and Hand Tools

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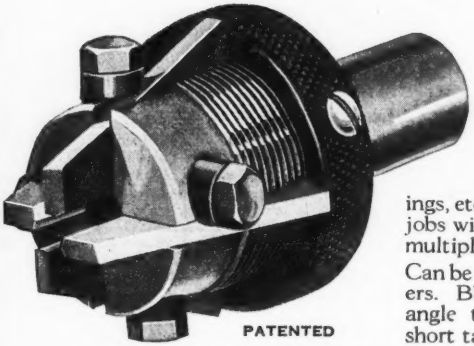

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Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

A Genesee Adjustable Hollow Mill can be made for every job

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"Tool Room Grinding" tells how to sharpen milling cutters and how to grind drills, taps, reamers, lathe and planer tools, and dies. A number of drawings and photographs are shown, showing how to hold the tools for grinding, and the kinds of chips that should be produced by properly-ground tools, etc. Published by Norton Co., Worcester, Mass.

Grinding Wheel Information: A booklet which tells how grinding wheels are made and graded, and which give instructions for mounting wheels, operating speeds for different kinds of work, instructions for truing and dressing, and other information has been issued by the Norton Company, Worcester, Mass. Sent free upon request.

Correct Cutter Grinding: How cutter costs can be reduced and more production per grind of cutter obtained is told in Booklet "E," published by The Oesterlein Machine Co., 3319 Colerain Ave., Cincinnati, Ohio. Sent free upon request.

"Ohio" Shapers and Planers: The latest types of shapers and planers manufactured by The Ohio Machine Tool Co., Kenton, Ohio, are described and illustrated in a series o bulletins that have been issued by this firm. All the latest features of these machines, such as automatic lubrication, instantaneous feed, centralized control, and gear box, are described in detail. Free upon request.

Self-Tapping Sheet Metal Screws: Screws which are threaded and hardened in such a manner as to enable them to cut their own threads as they are screwed into sheet metal assemblies are described in a folder which is published by the Parker-Kalon Corporation, 192-196 Varick St,. New York City., N. Y. Sent free upon request.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahn-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

"The Heart of the Machine Tool" is the title of a folder which describes the construction and method of operation of the Trahern Coolant Pump, manufactured by the Geo. D. Roper Corporation, Rockford, Ill. Copy free upon request.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Safety Grinding Wheels: The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

"Gold Seal" Precision Lathe: The various types and sizes of "Gold Seal" lathes that are manufactured by The Sebastian Lathe Co., 900 Culvert St., Cincinnati, Ohio, are described in detail in a catalog that is now published by the firm mentioned. The book is well illustrated with views of the lathe in operation and with cuts of the various units of the machine. Sent free upon request.

Equipment For the Shop: Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Il. Copy free upon request.

Rapid Drill Jigs: How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Siewek Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

"Chucks and Their Uses" is the name of a book which contains a full description of the different kinds of chucks and suggestions for the proper care of chucks, and tells how chucks should be fitted to lathes. It also contains a number of suggestions for general shop practice. Sent free upon application by The Skinner Chuck Co., New Britain, Conn.

Electric Drilling and Grinding Equipment: A book that is issued by The Standard Electric Tool Co., 1938 West Eighth St., Cincinnati, Ohio, tells how time can be saved, better work done, and the efficiency of the shop improved by the use of electrically-driven drilling and grinding equipment. Free upon request.

Engineering and Manufacturing Service: A complete engineering and manufacturing service for manufacturers who are not equipped to handle all of their own designing, experimental, or production work is described, with illustrations of the equipment available, in a bulletin that is issued by The Steel Products Engineering Co., Springfield, Ohio.

Material-Handling by Modern Methods: Modern methods of storing and transporting materials in the shop are discussed in a bulletin which also describes the various types of lift trucks manufactured by The Stuebing Cowan Company, 320 East Court St., Cincinnati, Ohio. Sent free upon request.

Sunoco Emulsifying Cutting Oil: A cutting oil that will allow of increased speeds, will prolong the life of the tools, preserves the cutting edges, prevents rust, and protects the operators from infections is described in a bulletin that can be had by writing to the Sun Oil Company, Philadelphia, Pa.

Twentieth Century Balancing Tools: A practical, sensitive and inexpensive device for balancing pulleys, flywheels, and other round parts is described and illustrated in a bulletin that will be sent without charge by the Sundstrand Machine Tool Co., Rockford, Ill.

Save Cutting Oil: How cutting oil can be separated from chips and thus reclaimed by the use of a centrifugal chip "wringer," is told in a bulletin that is issued free by the Tolhurst Machine Works, Troy, N. Y.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

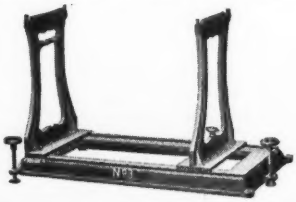
Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

OTHER PUBLICATIONS LISTED ON PAGES 70 AND 72.

For Sure Balance—

an absolutely level and solid "Way" is necessary



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are brought to an absolute *level* in ten seconds. No revolving parts.

The edges or "knives" upon which the work is tested are ground *true*, and are mounted upon the planed "ways" of a heavy bed or frame.

Standards adjustable to suit length of arbor.

Three sizes for floor—one for bench use

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The N. P. Bowsher Co., South Bend, Ind.

DETROIT SEMI-AUTOMATIC DRILLING MACHINES

Drills 900 to 1200 holes per hour.

Capacity—No. 60 to ⅜-in. Drills. Standard Fixtures will handle round or hex. stock. Five spindles, cam control. Unsurpassed for speed, accuracy and low cost operation. Over 1800 in successful operation.

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DESIGNERS AND BUILDERS OF SPECIAL MACHINERY

CONTRACT AND PRODUCTION WORK

Manufacturers of Spur, Spiral, Bevel and Worm Gears, cut to close tolerances.

Averbeck Shapers *Brehm Trimming Dies*

Building the Ford-Stout Plane

(*Continued from page* 12)

for the "nose," or leading edge, of the wings is shown in Fig. 6. Forms are supplied to act as gauges, each piece being formed especially to fit into a given place in the assembly. When a complete set of "nose" pieces has been formed, the set is taken to the assembly floor to be used as required.

The skeleton of a wing is shown under construction in Fig. 7. The huge jig is so constructed that every spar and rib can be locked in the jig in the exact position in relation to every other spar and rib that it is to occupy in the completed assembly. Having been previously jig-drilled, the pieces are riveted together and the completed assembly is then lifted out of the jig. Scaffolding is required, as shown, to enable the workmen to reach all parts of the wing-section, and mercury-vapor lamps are provided at both top and rear to furnish an ample supply of light at all times. As each wing is made up in three sections, there is one of these jigs for each section. The skin is put on while the section is in the jig, with the exception of parts upon which special operations are to be performed. Mail compartments are built into the wings in some instances, and sometimes special trap-doors for baggage storage are provided. Such special work is done after the wing section has been removed from the jig and laid upon horses, as shown in Fig. 8.

After the fuselage has been constructed in the jigs which were shown in Figs. 3 and 4, it is moved forward to the point where the three motors are assembled in position. Here the center section of the wing is added also, after which the two wing-tip sections are assembled to the plane. The operation of assembling one of the wing-tip sections to the center section is shown in Fig. 9.

During the process of these operations, the plane has been supported by portable horses at both front and rear; at this point, however, the front end is lifted by means of a crane and the landing gear is installed. This operation is shown in Fig. 10. All of the control cables, tubing, and minor accessories are now added, and the plane is ready for a flight test. After the flight test any necessary adjustments to the engines or controls are made, the plane is given a thorough inspection, and it is then turned over to the finishing department, where the chairs are installed and upholstered and the interior of the cabin is finished. Any painting or lettering required is done here, and the plane is finished.

At the present time the plant is turning out approximately 12 planes per month, ranging in size up to those of 16-passenger capacity. The public is fast becoming educated to the advantages and comparative safety of the Ford-Stout plane, however, and the demand for planes of this type is increasing at such a rate that the capacity of the plant will be doubled in the near future.

Angle Steel Catalog "C"

The Angle Steel Stool Company, Plainwell, Mich., has issued a catalog describing and illustrating the various kinds and types of equipment made by this firm. The catalog includes descriptions of metal chairs of all types for factory or office use, factory and office tables, wall desks, steel cabinets, addressograph cabinets, lockers, steel drill and reamer bins, steel bench legs, machine tenders, steel stands, steel hand trucks, wood-top trucks, casters, iron bar racks, and other equipment. The book contains 111 8½ x 11 pages.

The Greatest FRICTION CHUCK

Ever designed. GUARANTEED to eliminate tool breakage and increase production for tapping, deep hole drilling, reaming, stud and nut setting.

Taps held in Free Floating Collets driven by the square

The APEX SAFETY FRICTION CHUCK with FREE FLOATING TAP COLLET is revolutionizing old standards of chuck performance. It is bringing to the plants and shops of this country a new conception of chuck service. It is making phenomenal records in reducing costs and increasing production. Those who are using it on the most difficult jobs freely acknowledge it to be the greatest tool of its kind they ever used.

Send for our new Catalogue No. 5 describing

Apex Precision Production Tools

Safety Friction Chucks, Quick Change Drill Chucks, Positive and Friction Drive Vertical Float Chucks for Multiple Tapping, Self Aligning and Floating Tool Holders, Universal Joints.

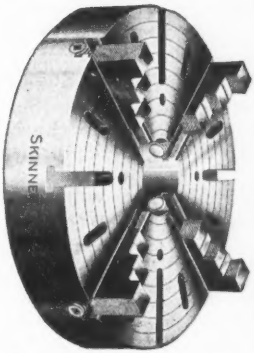
The APEX MACHINE CO. 305 DAVIS AVE. DAYTON, OHIO

Skinner Lathe Chucks

DEPENDABLE AS TIME

THE SKINNER 4-JAW

Independent Chuck, either iron or steel body, should be part of the equipment of every lathe.
The body is a well proportioned high-grade casting.
All movable parts are of special alloy steel, properly heat-treated.
Made in all the popular sizes.



May We Send You Our Complete Catalog?

THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN., U. S. A.

Riff-Raff Ravings

By GEO. ALEXANDER MANN
Raver-in-Chief

Poor Doc

"Want a brother or a sister?"
Doc asked of little Tony,
He said, "Doc, if you don't mind,
I'd rather have a pony."

If your dumb stunts do not lead you to wisdom, you're lost.

It's 'bout got so that if a man gets his wife a new fur coat at about the same time he gets a new stenographer, the world will insist that he musta been caught kissing the old one.

For shootin' their husbands,
They useta go to jail—
Now they go to vaudeville.

A Good Suggest

One good way for the ministers to get more people to church is to work with the gents' furnishing goods hounds on the styles o' clothes so that more men will be interested in what other men wear.

'Tis To Titter

"My dear, your stocking's wrinkled,"
Said he to Lizzie Braun;
She said, "Mind your bisness,
I got no stockings on."

If we could ditch anger, there'd be fewer doctors, less biz for lawyers an' undertakers, an' more jailers lookin' for jobs.

Whata Life

Sis gets home at 3 a. m.,
Maw follows with a grin,
Then they both sit up and wait
To let dear grandma in.

Ain't Ut Tha Troof?

There was a time when a lady's evening gown would come dern near fillin' a trunk. Now you'd have to sew three or four of 'em together to make a decent pen-wiper.

Two can quarrel, one can prevent it

THAT SHOT GOT HIM

'Tis told that an old pappy guy who wears high school clothes an' is famous for his young ideas, dropped into the store an' said he wanted to get some candles for his birthday cake, whereupon the sweet young thing behind the counter directed him to the wholesale department.

An Honest Confession

"You look like Helen Brown,"
He said to Lizzie Wright;
She said, "Yes? Well, you should see
What I look like in white."

Them Wuz Tha Days

Remember the good ol' times
When Dad whaled you with sprouts,
An' the grocer stuck potatoes
On the ol' time oil can spouts?

Our bevel gears are generated theoretically correct.

THE CINCINNATI GEAR CO.

1825-41 READING ROAD

CINCINNATI, OHIO

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Quick Service On Replacement

BECAUSE Formica sheets are carried in stock by leading gear cutters, very prompt service can be given when a gear goes bad and must be replaced. These gears on newspaper presses were replaced by a Formica gear cutter in five hours.

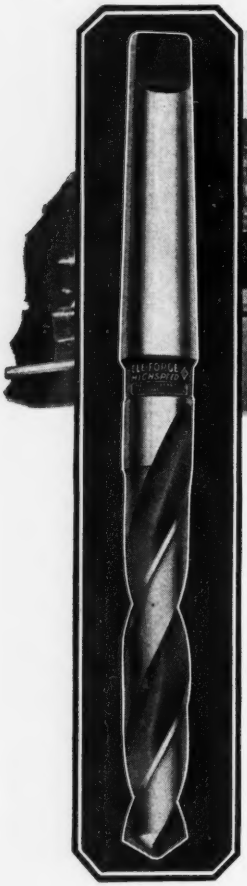
In service, Formica is silent and very durable.

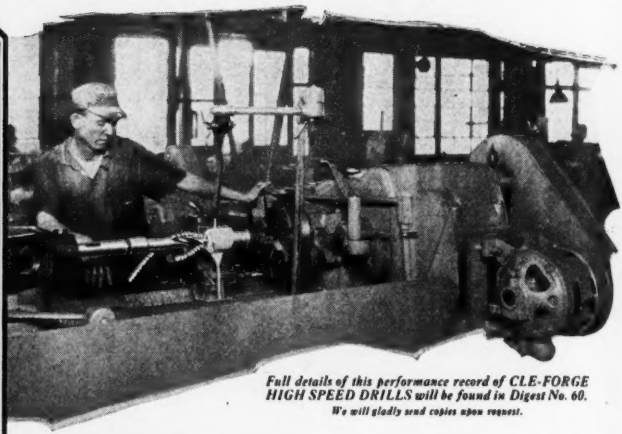
Sales departments of machinery manufacturers are demanding it because it makes the product easier to sell.

The Formica Insulation Company
4632 SPRING GROVE AVENUE
CINCINNATI, OHIO

FORMICA

50% More Holes—32.8% Lower Cost!





Full details of this performance record of CLE-FORGE HIGH SPEED DRILLS will be found in Digest No. 60. We will gladly send copies upon request.

FOUR years ago a large oil well tool corporation made a test of four different makes of high speed drills.

For each make, the speed and feed was set at the point where the chips came out blue through a good average flow of lubricant.

Out of this test emerged

CLE-FORGE HIGH SPEED DRILLS
TRADE MARK REG. U.S. PAT. OFF.

with somewhat higher limiting speeds and feeds—and with an average of about 50% more holes per grind!

On one typical job at this plant, investigated in the Spring of 1928, it was shown that the high speed drills formerly used averaged 15 holes per grind (as compared with 22 holes per grind for CLE-FORGE); a total life of 1500 holes per drill (as compared with 2,200 holes for CLE-FORGE); a unit cost of 67c per 100 holes drilled (as compared with 45c per 100 for CLE-FORGE)—

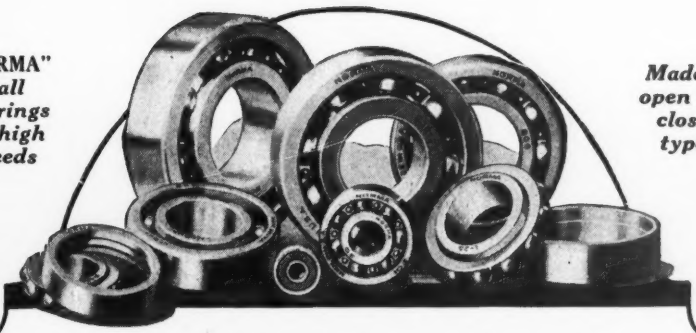
And that CLE-FORGE HIGH SPEED DRILLS *cost* exactly 32.8% less, although the initial *price* of each drill was identical.

CLE-FORGE HIGH SPEED DRILLS are offered to you on the soundest basis in the world—on the basis of their *proved performance* in actual daily operation.

The CLEVELAND TWIST DRILL COMPANY
CLEVELAND
NEW YORK · CHICAGO · LONDON
SAN FRANCISCO
TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

Manufacturers of Carbon and Cle-Forge High Speed Drills for every purpose; "Mezzo" Super-Carbon Drills; Hand, Jobbers' and Shell Reamers; "Peerless" High Speed Reamers; "Paradox" Adjustable Reamers; "Quick-Set" Reamers; "Spirex" Machine Taper Pin Reamers; Chucking Reamers for Turret Lathes; Counterbores; Countersinks; Sockets; End Mills; and the "Ezy-Out" Screw Extractor.

"NORMA" *Ball Bearings for high speeds*



Made in open and closed types

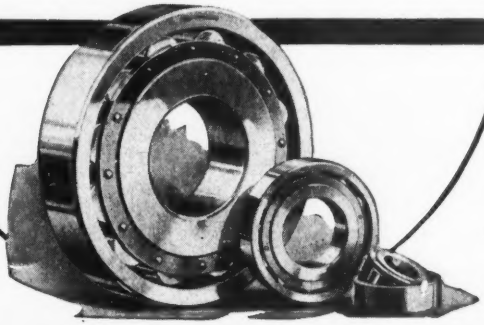
Whatever the load, whatever the speed, or whatever the service requirements

NORMA-HOFFMANN PRECISION BEARINGS

because of their quality, have a factor of safety which means longer life, uninterrupted service from the Norma-Hoffmann equipped tool or product—and lower ultimate costs.

Let a catalog give you the inside story.

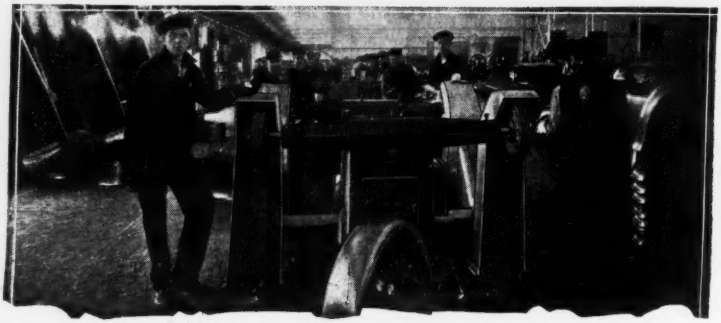
Norma-Hoffmann Bearings Corp'n
Stamford, Conn., U.S.A.



"HOFFMANN" *Roller Bearings for heavy duty*

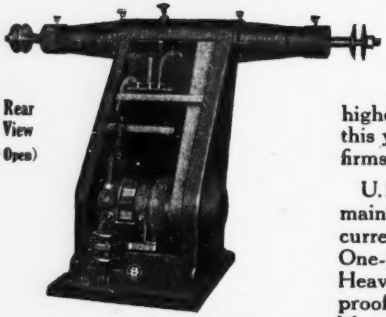
In sizes interchangeable with ball bearings

THE STANDARD MARK OF QUALITY
SINCE 1897



Comparative Tests Prove

U. S. Most Economical



Rear View Open)

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SELECTIVE SPEED
BUFFER and POLISHER

Made in 3, 5, 7½, 10 and 15 H.P. sizes, single or double spindles. Ball bearing motor in base, belted to one-piece nickel steel spindle supported by four heavy duty SKF Ball Bearings. Push button control, with no voltage release and overload protection. Dust-tight, etc., etc.

Wherever impartial, comparative tests are made with various makes of buffers and polishers, U. S. *Selective Speed* Buffers and Polishers score highest by several points. You can prove this yourself. Or let us send you names of firms who have made such tests.

U. S. *Selective Speed* Buffers and Polishers maintain their speed under load with least current consumption and reduction in speed. One-piece nickel steel spindle and four SKF Heavy Duty Ball Bearings protected by dust-proof housings assure long, trouble-free life. Superior general design, motor in base, equal distribution of metal and rugged construction give proper balance, thus reducing vibration.

Best of all, U. S. *Selective Speed* Buffers and Polishers provide any wheel speed desired from 2,000 to 3,000 r.p.m. Get all the facts. Ask your jobber or write us for catalog and prices today.

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